This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

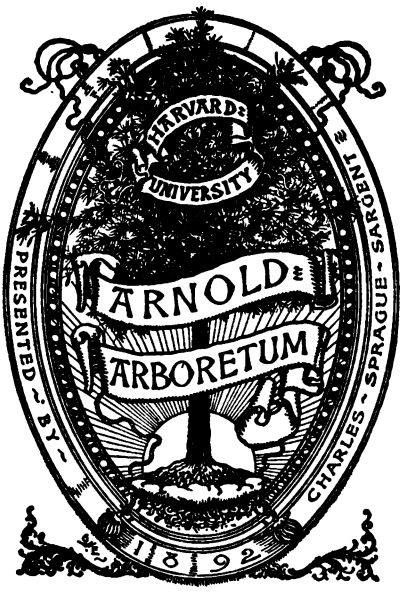
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

AM
Ha.6
JP



DEPOSITED AT THE
HARVARD FOREST
1941

S-4 III.34

Parlan
Board Reports

FOURTH REPORT

OF THE

BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY

OF THE

TERRITORY OF HAWAII

FOR THE YEAR ENDING DECEMBER 31, 1907

HONOLULU:
BULLETIN PUBLISHING CO., LTD.
1908.

OFFICERS AND STAFF

OF

THE BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY

1908

COMMISSIONERS

NAME	TERM EXPIRES
C. S. Holloway, *President and Executive Officer,*	January 1, 1909
P. R. Isenberg,	" " 1910
G. R. Carter,	" " 1911
Albert Waterhouse,	" " 1912
W. M. Giffard,	" " 1913

DIVISION OF FORESTRY

Ralph S. Hosmer, *Superintendent of Forestry and Chief Fire Warden.*

David Haughs, *Forest Nurseryman.*

David Kapihe, *Forest Ranger for Tantalus.*

DIVISION OF ENTOMOLOGY.

Alexander Craw, *Superintendent of Entomology and Inspector.* [Died June 28.]

A. Koebele, *Consulting Entomologist.*

Jacob Kotinsky, *Acting Superintendent.*

D. B. Kuhns, *Inspector's Assistant.*

B. M. Newell, *Fruit and Plant Inspector at Hilo, Hawaii.*

Robert R. Elgin, W. O. Aiken, W. D. McBryde, } *Fruit and Plant Inspector (Honorary)* { *at Mahukona, Hawaii.* " *Kahului, Maui.* " *Koloa, Kauai.*

DIVISION OF ANIMAL INDUSTRY.

Victor A. Nörgaard, *Superintendent of Animal Industry and Territorial Veterinarian.*

J. Charlton Fitzgerald, *Assistant Territorial Veterinarian* [until July 31.]

L. N. Case, *Assistant Territorial Veterinarian* [from Aug. 1.]

H. B. Elliot, *Deputy Territorial Veterinarian at Hilo.*

EDITOR, FORESTER AND AGRICULTURIST.

Leopold G. Blackman.

CONTENTS.

BOARD OF AGRICULTURE AND FORESTRY.

	Page
Report of the Commissioners	1
Legislation	1
Meetings of the Board	2
Publications	2
Division of Forestry	2
Division of Entomology	3
Division of Animal Industry	4
General	5
Appropriations	6
Salaries and Pay Rolls, 1905-07	6
Current Expenses, 1905-07	7
Fiscal Period, 1907-09	8

DIVISION OF FORESTRY.

	Page
Report of the Superintendent of Forestry	9
Introduction	9
Staff and appropriation	10
Forest Reserves	10
Reserve established	11
Projected reserves	12
Statistics of existing forest reserves	13
Tables I and II, areas of Forest Reserves	14-17
Forest reserve policy	18
Amendment to forest law	18
The two classes of Hawaiian forest	19
Needs in forest work	20
Fencing	21
Extermination of goats	21
Forest Extension	22
Tree planting	22
Seed and plant introduction	23
An information bureau	24
Miscellaneous forest work	25
Forest management	25
Education in forestry	26
Fungus disease on Maui	28
The district foresters	29
Changes in personnel	29
Reports of the district foresters	30
List of Sugar plantations now actively engaged in tree planting	30
Report of Mr. G. H. Fairchild	31
" " Mr. John Herd	32
" " Mr. W. F. Dillingham	33
" " Mr. Andrew Adams	34
" " Mr. Wm. F. Pogue	35
" " Mr. L. von Tempsky	35
" " Mr. George C. Watt	36
" " Mr. John M. Ross	36
" " Mr. J. Watt	37
" " Mr. J. A. Maguire	37

Page

The wild bird law 37
Tantalus and Nuuanu forests 38
Forest fire service 38
Periods of forest fire danger 38
Record of fires 39
May 30.—Waiakea, Hawaii 39
June 30.—Nuuanu Valley, Oahu 39
Summer 1907, Koolauloa, Oahu 40
Lack of money for fighting forest fires 40
Forestry in general 40
The lumber industry 40
Hawaiian Mahogany Lumber Company 40
American Hawaiian Mahogany Lumber Company 41
Hawaiian Development Company 42
Rubber 43
Coconuts 44
The outlook for 1908 44
Report of the forest nurseryman 47
The nursery 47
Collection and exchange of seed 47
Congressional vegetable seed 48
Growing and distribution of plants 48
Realization 49
Rubber 49
Ceara rubber 50
Nursery grounds 50
Advice and assistance 51
Hawaii 51
Puna Sugar Company 51
Oahu 51
Waialee Industrial School 51
Waialua Plantation 52
Catholic Mission Lands in Kalihi Valley 52
Wahiawa Water Company 52
Hawaiian Fibre Company 52
Waianae Uka, Ewa District 53
Maui 53
Kaupo, Maui 53
In and around Honolulu 53
Nuuanu Station 54
Tantalus Forest 54
List of persons receiving Central American Rubber plants 55
Seed and plant introduction exchange list 56
The Wild Bird Law 61
List of District Foresters 64
List of District Fire Wardens 68
Report of the Librarian 73
Library 73
Classification of books in the library of the Board of Agriculture and Forestry 74
Use of the Board building 74
Meetings 74
Exhibit room 75
Visitors 75
Clerical and routine work 75
Reports 76
Letters 76

Page
Distribution of Yearbooks and free seed 76
Personnel 77
Forester and Agriculturist 77
Buildings and grounds 77

DIVISION OF ENTOMOLOGY.

Page
Report of Superintendent of Entomology and Inspector 79
Inspection of importations 79
Importations of Japanese rice 79
Insects and other pests found upon importations 80
Potato pests 80
Infested garlic 81
Apple pests 81
Diseased sugar cane 81
Grape vine cuttings, etc. 82
Infested lupin seed 82
Rubber seed 82
Foreign fruits 83
Local inspection work 83
Mango scale 83
Fumigation of plants exported 83
General work 83
Introduction, breeding and distribution of beneficial insects... 85
Beneficial insect importations 85
California aphis parasite 85
Ladybirds from Mexico 86
Beneficial insect distributions 86
Arizona dung-fly parasite 86
Breeding 86
Distribution 86
Establishment 86
Effect of horn fly 87
Colonies of beneficial insects distributed during 1907 88
Siphanta or torpedo-bug parasite 89
Insect investigations in Mexico 89
Introduction 89
The moth-borer of the sugar-cane 90
Noctuid larvae in cane-tops 92
Leaf-hoppers 93
The large Mexican sugar-cane leaf-hoppers 93
The Mexican sugar-cane hopper 94
Fulgorid leaf-hoppers 96
Other insects on cane 96

DIVISION OF ANIMAL INDUSTRY.

Page
Inspection and Testing of Imported Stock 101
Rules and Regulations 101
Inspection for Parasitic Skin Diseases in Cattle 113
Results from Inspection Service 114
Importation of Live Stock 114
Importations of Dressed Meats and Dairy Products 118
Importations of Live Stock from New Zealand 120
Diseases among Live Stock in the Territory 123

Page

Osteoporosis in Horses 123
Osteomalacia in Cattle 124
Red Water in Cattle 124
Actinomycosis 125
Glanders 128
Observations Regarding Glanders on Island of Hawaii by Dr. H. B. Elliot 136
Epizootic Laryngitis in Horses 141
Eye Diseases in Cattle 145
Enzootic Stomatitis in Horses 151
Lead Poisoning in Cattle 153
Insect Pests of Live Stock 159
Horn-fly (Haematobia serrata, Desvoidy) 160
Warble-fly and Heel-fly 175
Hawaiian Sheep-Maggot-fly 177
The Turkey-Buzzard as an Enemy of Maggot-flies 181
Mule Breeding in Hawaii 183
Improved Veterinary Sanitary Service for Hawaii 186
The Pathological Laboratory 196
The Library of the Division of Animal Industry 199

ILLUSTRATIONS.

PLATES.

PAGE

Plate I. Fig. 1. Surface and section of potato showing injury by Potato Moth.

Fig. 2. The worms or larvae of Potato Moth.....to face page 80

Plate II. Exterior of new research Laboratory.....to face page 99

Plate III. Spraying imported cattle for lice and mange " " 113

Plate IV. Shorthorn bull, imported by Mr. A. W. Carter, for the Parker Ranch, Hawaii .....to face page 115

Plate V. Hereford bull, imported by Mr. A. W. Carter, for the Parker Ranch, Hawaii .....to face page 117

Plate VI. Jack imported for the Puakea Ranch, Hawaii.....to face page 185

Plate VII. Interior of new research Laboratory.....to face page 197

BOARD OF AGRICULTURE AND FORESTRY.

Report of the Commissioners.

To the Governor of Hawaii:

The report of the Board of Commissioners of Agriculture and Forestry for the year ending December 31st, 1907, is herewith presented.

LEGISLATION.

At the last session of the Legislature, two acts were passed pertaining to the work of this Bureau, as well as enlarging the powers and scope of the Commissioners.

One provided for the issuing of rules and regulations, subject to the approval of the Governor, covering the importation of honey bees, and as the honey industry in the islands has assumed considerable importance, and as far as is known no bee diseases are present here, it is very essential that every precaution be taken to prevent their introduction.

In the last report of the Commissioners, attention was called to the advisability of amending the law covering the setting aside of Government land for Forest Reserves, which allowed the use of Government unleased lands only for such purposes, so that the Governor, with the approval of a majority of this Board, would also have authority to set aside leased Government lands which would actually become a part of the Forest Reserves upon the expiration of the existing tenancies. It was thought that such a method of proceedure would be of advantage to private owners of lands adjoining, in that they would be fully informed as to the policy to be adopted by the Government in dealing with public lands for forestry purposes.

This amendment was passed and received the approval of the Governor on the 5th day of March 1907.

MEETINGS OF THE BOARD.

During the past year the Board has held 10 regular and 2 special meetings

By referring matters requiring action to the various Committees for recommendation to the Commissioners, it has been found that they can be more intelligently acted upon, and the routine work is greatly facilitated by this arrangement.

PUBLICATIONS.

In addition to the monthly issue of the Forester and Agriculturist, which has been edited under the direction of Mr. L. G. Blackman, with the intention of presenting matters of importance to the agricultural and stock raising interests here, the following press bulletin has been prepared and widely distributed.

Press Bulletin, Division of Entomology, No. 2, A Catalogue of the Aleyrodidae.

DIVISION OF FORESTRY.

The work of this Division has been carried on by the same staff as last year, a considerable portion of the time of the Superintendent having been devoted to field work on the various islands, in determining forest lines, and directing the surveys of proposed Forest Reserves.

A large number of trees as well as tree seeds have been sent out from the offices of the Board, and full information given to persons planting the same. In numerous instances private nursuries have been started with the view to obtaining trees for forest purposes, and where requested detailed planting plans have been prepared by this Division.

During the past year rapid development has been made, especially on the Island of Hawaii, in the lumbering of forests for commercial purposes, and the Superintendent of Forestry, Mr.

Hosmer, has been frequently consulted as to the best methods of cutting and preparing the trees for the market.

Fortunately, no serious forest fires have occurred, but the need of a special fund for extinguishing fires on Government land and property immediately adjacent thereto, to be expended by the Board with the approval of the Governor is strongly urged.

The lack of an appropriation for the employment of Forest Rangers has made it impossible to properly look after the reserves already established, in order to see that the fences are kept in good condition and that stock is prevented from entering the forests. It is certainly necessary to have money for this purpose, in order that the maintenance of the reserves can be carried on in an efficient manner, and it is to be hoped that the Legislature will find it possible to provide for this service.

DIVISION OF ENTOMOLOGY.

Mr. Alexander Craw has continued as Superintendent of this Division with the same assistants as last year, a greater portion of his time being devoted to the inspection of fruits, plants etc. brought here as freight, and arriving through the mails. At this port alone, 102,151 packages were examined, and all that were found to be infested with any injurious insect life or plant disease were either thoroughly fumigated or destroyed.

Considerable attention has been paid to the collecting and breeding of beneficial insects for distribution on the various islands, and Mr. A. Koebele the Board's Consulting Entomologist, has for several months been searching for such insects in Mexico. Several shipments have been made from there and the insects upon arrival here have been bred under the direction of the Assistant Entomologist at the Government Nursery. When colonies are released observations are taken, and reports made from time to time, as to results obtained in the various districts where they have been released, which in many cases are very encouraging, showing that undoubtedly considerable benefit has been obtained.

The officials of this Division have been frequently consulted in regard to the treatment of plant diseases, which have proved injurious in various localities, and it is the desire of the Commissioners that all persons interested should take advantage of the opportunity of referring such matters to the Board's Entomologists. Where it is considered necessary field observations are taken, and full data furnished in answer to all inquiries.

DIVISION OF ANIMAL INDUSTRY.

No change has been made in the personnel of this Division with the exception of the addition to the staff of one person who acts as clerk and stenographer.

The most important work has been the eradication of glanders on the various islands, and the prevention of the introduction of this disease through importations from the mainland. Where cases have been reported either the Territorial Veterinarian Dr. V. A. Norgaard or his assistant has made personal examination of the same and where an animal has been found with glanders it has been immediately destroyed, the necessary precautions being taken to prevent the spread, through contagion, of this very dangerous disease. At the present time conditions are good, only a few sporadic cases appearing now and then.

By requiring the mallein test of all horses and mules imported into the Territory the danger of infection through this source has been materially lessened.

An appropriation having been made by the last Legislature for a laboratory, the same was built adjoining the offices of the Board, and it has been thoroughly fitted out with the latest instruments and apparatus. This addition to the Board's equipment will be of undoubted benefit in the study of all animal diseases, as microscopic examinations are absolutely essential to the scientific investigation of suspected cases.

Considerable time has been devoted to the treatment of sheep diseases found on the various ranches, and under the direction

of the Veterinarian the most approved types of dipping apparatus have in several instances been installed, and most satisfactory results obtained.

It is to be hoped during the coming year that a thorough study can be made of the heart worm which has proved so destructive to dogs especially those of finer breeding, and that some remedy can be found for this disease.

GENERAL.

The results obtained during the past year have been most encouraging, and it is to be hoped that the Legislature as well as the general public will appreciate the importance of fully maintaining the various divisions of the Bureau in order to increase the forest areas, to protect those already established, and to prevent the introduction of injurious insects as well as dangerous plant and animal diseases which might prove most disastrous to the agricultural and stock raising interests here.

Respectfully submitted,

C. S. HOLLOWAY,
W. M. GIFFARD,
G. R. CARTER,
P. R. ISENBERG,
ALBERT WATERHOUSE,
Commissioners.

Honolulu, Hawaii,
December 31, 1907.

APPROPRIATIONS FOR BOARD OF AGRICULTURE AND FORESTRY PASSED BY THE LEGISLATURE AT THE EXTRA SESSION OF 1905, FOR THE BIENNIAL PERIOD, JULY 1, 1905, TO JUNE 30, 1907, WITH SOME ADDITIONAL APPROPRIATIONS PASSED BY THE LEGISLATURE OF 1907.

Statement January 1 to June 30, 1907.

SALARIES AND PAY ROLLS.

	Appropriation.	Balance Dec. 31, 1906.	Drawn.	Amount Unexpended June 30, 1907.
Salary of Superintendent of Forestry	$ 6,000.00	$ 1,796.77	$ 1,500.00	$ 296.77
Pay of Assistants, Laborers and Rangers, Division of Forestry	4,000.00	1,080.00	1,080.00	0.00
Salary of Superintendent of Entomology	6,000.00	1,500.00	1,500.00	0.00
Pay of Assistants, Inspectors and Employees, Division of Entomology	5,000.00	1,354.52	1,349.50	5.02
Salary of Clerk and Stenographer	1,800.00	450.00	450.00	0.00
Salary of Territorial Veterinarian	1,400.00	350.00	350.00	0.00
Pay of Assistants, Inspectors, Employees and Laborers, Division of Animal Industry	1,000.00	410.00	410.00	0.00
	$ 25,200.00	$ 6,941.29	$ 6,639.50	$ 301.79

CURRENT EXPENSES.

	Appropriation.	Balance Dec. 31, 1906. and Additional Appropriations.	Drawn.	Amount Unexpended June 30, 1907.
Incidentals and General Expenses:				
Contracts carried over from the Fiscal Period 1903-05...	$ 1,098.09	$ 1.65	$ 0.00	$ 1.65
Incidentals and General Expenses and Experimenting in growing Rubber Trees on Government Forest Lands	29,848.00	7,710.16	8 877.25	37.98
Additional Appropriation for Departmental Use: Act 9, Session Laws of 1907: Board of Agriculture and Forestry, Incidentals	1,500.00	1,500.00		294.93
Contracts carried over July 1, 1907				
Assistance to Federal Experiment Station	5,472.00	537.18	2,536.82	.36
Additional Appropriation: For the immediate use of the Hawaii Agricultural Experiment Station: Act 95, Session Laws of 1907	2,000.00	2,000.00		
Incidental and General Expenses, Bureau of Animal Industry	250.00	.75	0.00	.75
Unpaid Bill: Board of Agriculture and Forestry: Period of 1905-07: Act 91, Session Laws of 1907	200.60	200.60	200.60	0.00
	$ 40,368.69	$ 11,950.34	$ 11,614.67	$ 335.67

APPROPRIATIONS FOR BOARD OF AGRICULTURE AND FORESTRY PASSED BY THE LEGISLATURE AT THE SESSION OF 1907, FOR THE BIENNIAL PERIOD JULY 1, 1907, TO JUNE 30, 1909.

Statement to December 31, 1907.

SALARIES AND PAY ROLLS.

	Appropriation.	Drawn.	Balance.
Salary of Superintendent of Forestry	$ 6,000.00	$ 1,500.00	$ 4,500.00
Pay of Assistants, Laborers and Rangers, Division of Forestry	9,240.00	2,005.50	7,234.50
Salary of Superintendent of Entomology	6,000.00	1,500.00	4,500.00
Pay of Assistants, Inspectors and Employees, Division of Entomology	11,280.00	2,800.00	8,480.00
Salary of Clerk and Stenographer	2,400.00	600.00	1,800.00
Pay of Employees and Laborers Board of Agriculture and Forestry	2,160.00	540.00	1,620.00
Salary of Superintendent of Animal Industry	6,000.00	1,500.00	4,500.00
Pay of Assistants and Laborers, Division of Animal Industry	6,760.00	1,189.96	5,570.04
	$ 49,840.00	$ 11,635.46	$ 38,204.54

CURRENT EXPENSES.

Contracts carried over from Fiscal Period of 1905-07	$ 294.93	$ 224.93	$ 70.00
Incidentals and General Expenses Board of Agriculture and Forestry	$ 37,050.00	$ 4,867.98	$ 32,182.02

DIVISION OF FORESTRY.

Report of the Superintendent of Forestry.

Honolulu, Hawaii,
December 31, 1907.

The Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen:—

I have the honor to present my fourth annual report of the work of the Division of Forestry.

On the part of the Territory itself the points of notable interest during 1907 in the history of forestry in Hawaii are a definite annunciation of policy in regard to the two main classes of Hawaiian forest; the extension of the forest reserve system, through the setting apart of additional areas and the completion of field work bearing directly on the creation of other new reserves; the establishment of a systematic exchange of seed with Botanic Gardens and other similar institutions; and an amendment to the forest law giving to the Governor more extended power in the creation of forest reserves.

On the part of private interests and corporations there is also much that is worthy of record. Particularly to be noted is the increasing interest in tree planting on waste lands; the extension of the rubber plantations on Maui; the beginning of a coconut industry; and especially the real establishment of the lumber industry in the leeward districts on Hawaii through the signing of a contract between the Hawaiian Mahogany Lumber Company and the Santa Fe Railway System whereby there will be sent to the mainland during the next five years over 2,500,000 Ohia Lehua railroad ties.

In the successful development of any undertaking much depends on a good start. The various branches of forest work that have just been enumerated are practically all in the initial stage. Begun as each has been in accordance with orderly and carefully made plans, the things undertaken during 1907 may justly be regarded in each case as the auspicious beginning of a permanently important enterprise.

STAFF AND APPROPRIATION.

During 1907 the official staff of the Division of Forestry has consisted of the Superintendent of Forestry (Ralph S. Hosmer) and the Forest Nurseryman (David Haughs.) Of the volunteer staff—the District Foresters and the District Fire Wardens—there have been some changes in personnel. Revised lists of the gentlemen serving in these positions are given elsewhere in this report. David Kapihe has continued as Forest Ranger for the Tantalus Heights District. No other forest rangers have been appointed.

For the biennial period ending June 30, 1907, the item in the appropriation bill for the salaries and pay rolls of the Division of Forestry was $5,000. per annum. The amount per annum allotted to current expenses was $5,450. For the present fiscal period (July 1, 1907 to June 30, 1909) the Division of Forestry receives the following allotment:

Salaries and pay rolls, per annum,..... $7,620.
Incidentals and Current Expenses, per annum,.. 4,960.

The seeming increase in the salary item is due to the transfer of certain laborers from the general pay roll of the Board to that of the Division of Forestry. The number employed remains the same.

FOREST RESERVES.

Since the organization of the Division of Forestry the creation of forest reserves has rightly been held to be the forest work

of first importance. The successful development of agriculture in Hawaii, especially in the districts where irrigation is necessary, is so closely bound up with the welfare of the forest that it is of paramount importance that the forest cover on the water sheds be carefully and wisely managed. It cannot too often be said that the chief value of by far the greater part of the Hawaiian forest does now and always must rest in the influence that the forest exerts on the conservation of water. For the maintenance of a permanent, dependable supply the forest is essential.

The methods that are followed in the creation of forest reserves in Hawaii, with other information in regard to the reserves established, have been covered fully in former reports. It may, however, not be out of place here to state again that the prime object in the creation of all but one of the thirteen forest reserves that have so far been established is to protect the forest on the water sheds of the important streams. These forest reserves are essentially "protection forests." Their most valuable product is water. By safeguarding the sources of the supply they render direct economic return to the Territory.

RESERVE ESTABLISHED.

On June 12, 1907, there was created by proclamation of Acting Governor A. L. C. Atkinson the Na Pali-Kona Forest Reserve on the Island of Kauai. This reserve has a total area of 60,540 acres, of which 40,650 acres is Government land. The Na Pali-Kona Forest Reserve embraces the great Waimea Upland and the major part of the table-land in the District of Na Pali. This section is important because from it come numerous streams that are now or that later can be used for power development and irrigation. From its location and topography the land included in the reserve cannot permanently be used to advantage other than for water production. Its value depends almost wholly on the water that can be got from it. Accordingly this reserve falls naturally into the "protection forest" class.

Of the Government land in the Na Pali-Kona Forest Reserve (40,650 acres) 3980 acres was not under lease and could definitely be set apart at once. Under the amended forest law the remainder of the Government land now under lease—for the most part to the Knudsen Estate—will automatically come into the fully reserved class at the expiration of the existing leases. Most of the private lands in this reserve are owned or controlled by Messrs. Gay and Robinson. For some years both the Knudsen Brothers and Messrs. Gay and Robinson have protected the area now officially reserved and maintained it as two private forest reserves. The wild cattle have been systematically hunted and kept down; as a result the forest as a whole is in excellent condition.

PROJECTED RESERVES.

Owing chiefly to matters that have arisen in connection with the change in August of the Territorial Administration, several other reserve projects that naturally belong to 1907 go over to 1908 for final action. Three proposed forest reserves pending final action on December 31, 1907 are the West Maui Forest Reserve, total area 44,440 acres; the Makawao Forest Reserve, also on Maui, 1793 acres; and the Waiaha Spring Forest Reserve in North Kona, Hawaii, 193 acres.

During 1907 field work has been completed and the surveys of boundaries made for a large additional forest reserve on Kauai, for the Kohala Mountain Forest Reserve on Hawaii and for additions to the reserves on the Waianae Mountains on Oahu. These projects now only await the preparation of the technical descriptions to be finally put through. Field work done in Kona, Hawaii and on the slopes of Mount Haleakala on Maui during the autumn of 1907 will in due course lead to the creation of other reserves, so that by the end of 1908 the chain of the principal forest reserves throughout the Territory should be practically complete.

STATISTICS OF EXISTING FOREST RESERVES.

The total area within the boundaries of the established forest reserves on December 31, 1907 is 397,687 acres. Of this 252,818 acres is Government land. The following tables show chronologically and by counties various data in connection with the thirteen Hawaiian forest reserves.

For a detailed statement of the areas of the various lands making up the several reserves, reference should be made to the tables in the report of the Division of Forestry for 1906, pages 32 to 42. In that report also may be found maps showing the location of the forest reserves on each of the four larger islands of the Territory.

TABLE I.

FOREST RESERVES--TERRITORY OF HAWAII.

ARRANGED IN CHRONOLOGICAL ORDER.

No.	Name	District	Island	Total Area Recommended to be Reserved	Area Government Land	Area Private Land	Date of Proclamation	Proclamation Signed by
				Acres	Acres	Acres		
1	Kaipapau	Koolauloa.....	Oahu	913	913	.....	Nov. 10, 1904	G. R. Carter
2	Hamakua Pali..	Hamakua	Hawaii ..	18940	16333	2607	Dec. 23, 1904	" "
	Total for the	year ending Dec	31, 1904	19853	17246	2607		
3	Hilo.....	Hilo.....	Hawaii ..	110000	60223	49777	July 24, 1905	A. L. C. Atkinson
4	Koolau, Maui ..	Koolau, Hamakua-loa.....	Maui.....	42969	30230	12739	Aug. 24, 1905	" "
5	Halelea, ...	Halelea	Kauai.....	37500	10990	26510	Aug. 24, 1905	" "
	Total for the	year ending Dec.	31, 1905	190469	101443	89026		
6	Kealia	Puna.....	Kauai.....	9935	7385	2550	Mar. 9, 1906	" "
7	Ewa	Ewa Waianae and Waialua.....	Oahu	28550	5151	23399	Mar 9 1906	" "

TABLE I.—Continued

No.	Name	District	Island	Total Area Recommended to be Reserved	Area Government Land	Area Private Land	Date of Proclamation	Proclamation Signed by
				Acres	Acres	Acres		
8	Honuaula.....	Kona.....	Hawaii ..	665	665	.....	April 4, 1906	A L. C. Atkinson
9	Kau	Kau.....	Hawaii ..	65850	59618	6232	Aug. 2, 1906	G. R. Carter
10	Waianae kai ...	Waianae	Oahu	3257	3150	107	Sept. 7, 1906	" "
11	Lualualei..	Waianae..	Oahu	3743	3743	....	Nov 30, 1906	" "
12	Hana.....	Hana	Maui.....	14825	13767	1058	Nov. 30, 1906	" "
	Total for the	year ending Dec.	31, 1906 ..	126825	93479	33346		
13	Na Pali-Kona..	Na Pali and Kona	Kauai.....	60540	40650	19890	June 12, 1907	A. L. C. Atkinson
	Total for the	year ending Dec	31. 1907	60540	40650	19890		
	Grand Total	.....	.....	397687	252818	144869		

Table II shows the same data for the existing reserves, arranged by islands and counties.

TABLE II.

FOREST RESERVES--TERRITORY OF HAWAII

ARRANGED BY ISLANDS AND COUNTIES

No.	Name	District	Island	Total Area Recommended to be Reserved	Area Government Land	Area Private Land	Date of Proclamation	Proclamation Signed by
			COUNTY OF KAUAI					
				Acres	Acres	Acres		
5	Halelea	Halelea	Kauai	37500	10990	26510	Aug. 24, 1905	A. L. C. Atkinson
6	Kealia	Puna	"	9935	7385	2550	Mar. 9, 1906	" "
13	Na Pali-Kona	Na Pali and Kona	"	60540	40650	19890	June 12, 1907	" "
		Total		107975	59025	48950		
			COUNTY OF OAHU					
				Acres	Acres	Acres		
1	Kaipapau	Koolauloa	Oahu	913	913		Nov. 10, 1904	G. R. Carter
7	Ewa	Ewa, Waianae and Waialua	"	28550	5151	23399	Mar. 9, 1906	A L. C. Atkinson
10	Waianae-kai	Waianae	"	3257	3150	107	Sept. 7 1906	G. R. Carter
11	Lualualei	Waianae	"	3743	3743		Nov. 20, 1906	" "
		Total		36463	12957	23506		

TABLE II---Continued

No.	Name	District	Island	Total Area Recommended to be Reserved	Area Government Land	Area Private Land	Date of Proclamation	Proclamation Signed by
			COUNTY OF MAUI					
				Acres	Acres	Acres		
4	Koolau, Maui	Koolau, Hamakualoa	Maui	42969	30230	12739	Aug. 24, 1905	A. L C. Atkinson
12	Hana	Hana	"	14825	13767	1058	Nov. 30, 1906	G. R. Carter
		Total		57794	43997	13797		
			COUNTY OF HAWAII					
				Acres	Acres	Acres		
2	Hamakua - Pali	Hamakua	Hawaii	18940	16333	2607	Dec. 23, 1904	G. R. Carter
3	Hilo	Hilo	"	110000	60223	49777	July 24, 1905	A. L. C Atkinson
8	Honuaula	Kona	"	665	665		Apr. 4, 1906	"
9	Kau	Kau	"	65850	59618	6232	Aug. 2, 1906	G. R. Carter
		Total		195455	136839	58616		
		Grand Total		397687	252818	144869		

FOREST RESERVE POLICY.

In addition to the increase in area through lands actually set apart the most important events in connection with forest reserve work in Hawaii during 1907 have been certain changes in the forest law and a definite statement of the forest reserve policy as it applies to the two main classes of forest in Hawaii.

Amendment to Forest Law.

Act 4 of the Session Laws of 1907 amends the already amended Section 379 of Chapter 28 of the Revised Laws of Hawaii by making the section read that "the Governor may set apart any Government land or lands whether under lease or not, as forest reservations, provided, however, that on lands under lease the reservation shall not take effect until the expiration of the existing lease, or in any way affect the rights acquired under the lease."

Before the enactment of this amendment land that was under lease could only be set apart within the two years prior to the expiration of the lease. Under the new arrangement all Government land within the boundaries of a given forest reserve may be set apart at any time; the full reservation on leased land to go into effect, automatically, at the expiration of the lease. The advantage of the present law is that it tends to establish the forest reserves more firmly. Under this law the policy of the Government in regard to the future use of the lands in any given forest reserve is clearly defined. Being assured that the Government forest lands in a certain section are to be reserved, private owners of adjoining tracts are more likely to cooperate with the Board of Agriculture and Forestry in maintaining their own lands under forest cover.

Under the amended law there have been, through proclamations of the Governor, several changes in the status of Government lands in existing forest reserves, notably in the Koolau and the Hana Forest Reserves on Maui.

The Two Classes of Hawaiian Forest.

In June 1907 an application for the right to lumber the forest on the Government land of Piihonua, in the Hilo District, Island of Hawaii, brought out a definite statement of the fundamental differences in the two main classes of Hawaiian forest and the reasons why it is necessary that radically different methods should be followed in their management.

In a report dated July 18, 1907 (published in the Hawaiian Forester and Agriculturist for August 1907; Volume IV, Number 8; pages 252 to 256) the Superintendent of Forestry pointed out that in Hawaii there are two main classes of forest: the water-bearing PROTECTION FOREST, essentially of value because of the *water* it can produce; and the non-water-bearing COMMERCIAL FOREST, the main value of which rests in the *wood and timber* that it yields.

In the water-bearing forest the most important product is *water*, and consequently the forest ought to be so managed as to yield permanently the largest possible dependable supply. With the short water sheds, the steep slopes and the susceptibility of the Hawaiian forest to injury, to secure the best results in most of the water-bearing forests it is essential that the forest cover be kept strictly intact—that the forest be maintained exclusively as a protection forest.

In the leeward districts on Hawaii a different condition prevails. Here there are no permanent streams and but few springs. Consequently the forest is not needed for water shed protection, but is to be reckoned chiefly of value because it can be made to yield wood and timber. Much of the land in Kona, Puna and Kau can be used to better advantage for growing trees than for any other purpose. Obviously the wise use of this type of forest is so to manage it that it shall yield repeated crops of valuable timber. The object in both cases is to put the forest to wise use; to make it serve the purpose for which it is best adapted. In the one case its most valuable product is water; in the other it is wood.

The Piihonua forest protects the head waters of one of the most important streams in the Territory—the Wailuku River. It is above all else of value because of its influence on the flow of this stream. Essentially a protection forest it should be kept strictly intact. This was the gist of the report of the Superintendent of Forestry.

The Board of Agriculture and Forestry approved the recommendation that the Piihonua forest should not be lumbered. The Commissioner of Public Lands, backed by Governor Carter, acted in accordance with the recommendation of the Board. There was thus established a precedent in the forest policy of the Territory that is of great importance.

NEEDS IN FOREST WORK.

Owing to the lack of a sufficient appropriation to permit the employment of forest rangers, the Division of Forestry has not been able to render the efficient service in caring for the forest reserves that is essential to their best management. It is a defect that must be overcome before the forest reserves can be made to do their full duty. Consequently the fight for forest rangers must continue to be waged until an efficient system of administration is provided for.

The absence of forest rangers reacts unfavorably on the forest reserve system in two ways. First, it is now impossible to take the effective steps toward suppressing trespass by stock and toward preventing forest fire that would immediately follow the appointment of forest rangers. Second, it naturally follows that private corporations and individuals hesitate, as conditions now are, to turn over their forest land to the Board of Agriculture and Forestry for management. To secure the best results all the lands in any given forest reserve should be under one central authority. It stands to reason that men whose business it is to manage forests must know more about the matter than do persons to whom the care of the forest is but one of many intertests. Given an administrative force, the Terri-

torial Forest Service could manage the forest lands better than can the individual. When the Government can offer this inducement, there will be no trouble in getting the private owners to cooperate with the Government in the proper management of the forest reserves.

In this connection it may be encouraging to note that Hawaii is now but passing through a stage similar to that in which about a decade ago the National Forests on the American mainland stood for several years. Although at present the Hawaiian forest reserves may seem to be more in evidence on paper than on the ground, they have nevertheless been definitely set apart, so that as soon as means of administration are provided there will be no delay in bringing the whole area under efficient management. What has been done so far is a necessary and indispensable step. This fact justifies the outlay that has been made.

Fencing.

Another need in local forest reserve work is that certain forest reserve boundaries should be fenced. Wherever possible natural barriers are used to mark the reserve limits, but there are many places where fences are required. Often a short stretch of fence will protect large areas. There should be a special fund appropriated by the next Legislature for this purpose.

Extermination of Goats.

One other point of needed legislation may also be mentioned here. Act 116 of the Session Laws of 1907 provides that every person hunting with fire arms shall pay to the County where he is to hunt, a tax of five dollars. The law is a good one but it should be so amended as to provide for the free shooting of wild goats in established forest reserves. These animals do much damage and should be exterminated. By a permit system, it could easily be arranged so that the privilege of hunting without a license could not be abused. The gain to the County

from the destruction of the goats would off-set what little revenue might be lost. Already in one case, on Kauai, the Supervisors have authorized the remission of the tax, where a party of young men was systematically to hunt the goats in one of the Kauai forest reserves.

FOREST EXTENSION.

The two main branches of the Division of Forestry are the Sections of Forest Reserves and of Forest Extension. Forest Extension includes cooperative assistance in tree planting, the introduction and trial of exotic seed and plants, and the collection and distribution of island grown tree seed and seedlings. This work is carried on under the direct charge of Mr. David Haughs, the Forest Nurseryman. In Mr. Haughs' report will be found a statement of what has been accomplished during the year. It is unnecessary to summarize this report for it is not so long but that it may easily be read.

TREE PLANTING.

It may however well be noted here that the forest work carried on through the Section of Forest Extension is each year coming to have a larger place in the affairs of the Territory. The diminishing supply of wood and timber on the American mainland, the consequent rise in price of all wood products, the local need of wood suitable for fence posts, railroad ties, bridge timbers and the like, not to speak of general construction timber, and the necessity for a cheap fuel supply—that already in some districts is a serious problem—all point to the wisdom of tree planting.

All over the Territory are areas of waste land that can be made useful and productive by growing trees. These lands cannot profitably be used for any other crop. Under the conditions that obtain in Hawaii, forest planting is a good investment. Among the introduced trees are many quick growing species

that yield wood and timber exactly adapted to local needs. The Division of Forestry stands ready to give expert advice as to what, where and how to plant to get the desired results. This advice is practically free—only the travelling expenses of the agent sent are charged to the applicant, and often even this charge is distributed among several applicants. During the past year the interest in tree planting has increased notably. It ought to continue steadily to gain, for there can be no question that those who today are thus turning to account the gulch sides and other unproductive corners of their land will in the coming years have reason frequently to be glad of their foresight.

SEED AND PLANT INTRODUCTION.

Another feature of the work in Forest Extention that deserves special mention is the introduction of exotic trees and shrubs of economic value to the Territory. The systematic exchange of seed, with the careful propagation and eventually the distribution of important introduced trees is one of the chief services rendered by this Section of the Division of Forestry. Hawaii is fortunate in having already secured among others such additions to its arborescent flora as the Algaroba, the various Eucalyptus, the Ironwoods, the Silk Oak and the Japanese Cedar. But there are other trees quite as valuable that have not yet been tried.

It is peculiarly the business of the Division of Forestry to carry on this work, for the seed and seedlings of many of the imported trees require to be handled with particular care, such as can only be given by technically trained men. At the Government Nursery are specially constructed propagating houses, where seed that it is difficult to grow can be given every advantage. Later, when the seedlings grow to be large enough to plant out safely, it is a part of the program of the Division of Forestry to see that each new kind goes to some place in the Territory where it is likely to do well—a matter depending on elevation, exposure, soil, and moisture. Through the coopera-

tion of volunteer observers in different parts of the Territory much valuable information will in due course be got together as to the exact worth in Hawaii of the newly introduced trees. The past year is notable in that it marks the definite beginning of this work on a large scale.

A problem of great forest interest is the afforestation of the upper slopes of the higher mountains of the Territory with trees from the Temperate zones—preferable with conifers. Arrangements to begin experimental planting during the summer of 1907 had been made in cooperation with the United States Forest Service but owing to a ruling of the Comptroller of the United States Treasury, the project had to be abandoned. It is expected, however, that the plan can be carried out in 1908.

AN INFORMATION BUREAU.

Besides being charged with the execution of the two more important branches of Forest Extension—cooperative assistance in tree planting and seed introduction—Mr. Haughs has a large amount of detail to see to in connection with the routine work at the Government Nursery. The answering of inquiries on forest, horticultural, botanical and other kindred matters, the oversight of the propagation, sale and free distribution of the seed and seedlings of the trees in common demand, and the care of the herbarium and seed collections are all matters of importance. Special mention of them is made here because it is the desire of the Staff of the Division of Forestry that the people of the Territory shall know and make use of these opportunities. Persons desiring information on any subject germain to forest work will be assisted in every way possible. Application may be made in person or by letter. In either case requests will receive prompt attention.

MISCELLANEOUS FOREST WORK.

FOREST MANAGEMENT.

Besides cooperating with private owners in tree planting the Division of Forestry also stands ready in cases where the wise use of the forest is through commercial utilization, to advise owners of forest land as to proper methods of forest management. This work is done under the same terms that govern the preparation of planting plans; the offer is contained in Circular No. 1 of the Division of Forestry.

In 1907 the Superintendent of Forestry made two investigations of forest problems on the Island of Hawaii under this offer. Both were made at the request of the Trustees of the Bernice Pauahi Bishop Estate: in one case there was desired a report on the progress and methods of the Hawaiian Mahogany Lumber Company in the lumbering operations on the Bishop Estate land of Keauhou in Kau; in the other, recommendations as to the proper use, protection and development of the lands belonging to the Bishop Estate in the District of Kona. In connection with the other field work on Hawaii both problems were investigated on the ground, respectively in June and September 1907. A report on the former was submitted to the Trustees of the Bishop Estate in July; the report on the latter, due to a pressure of official work was still in preparation at the end of the year.

The report on the lumbering was an impartial statement of existing conditions, together with certain recommendations looking to the future welfare of the forest. The report on the Kona forest will contain a statement of the forest situation in that district, brief descriptions of the forest on the several lands belonging to the Estate, and suggestions as to how the forest could be maintained permanently and at the same time used wisely, through the conservative lumbering of the commercially valuable trees under the methods of practical forestry.

In Hawaii where a forest is not needed for stream protection,

its chief value lies in the wood and timber it can produce. It follows that the wise use of that forest is so to manage it that it shall yield repeated crops of wood or timber. Where, as is the protection forests in the windward districts of Hawaii, the most valuable product of the forest is water, the wise use of that forest is so to manage it that it shall yield permanently the greatest possible regular supply of water. In both cases the object is to make the forest render the service for which it is best adapted.

A large part of the forest in Kona belongs to the commercial class. In Kona there are no permanently running streams and few springs. The need of the forest as a protective cover consequently gives place to its value as a source of wood and timber. Much of the land now under forest in Kona is of only slight value for other use. Properly managed it could be made to yield repeated crops of timber of excellent quality, commanding good prices. The purpose of forest management is to do just this. Therefore, forestry can and should be practiced in Kona. This is the gist of the recommendations to be embodied in the Bishop Estate Report.

During the examination of the Kona lands verbal recommendations, similar in tenor to those just outlined, were also made to members of the Greenwell Estate, on the care and management of certain of their forest land.

EDUCATION IN FORESTRY.

The ultimate success of forestry in Hawaii depends on the continued cooperation of individauls and private corporations with the Territorial Government. In a county where so much of the forest area is in private ownership it is essential that this relation be cordial and active. To promote a better understanding and to bring home to those controlling forest land the advantages of forestry, education becomes one of the necessary parts of forest work in Hawaii. It includes the general dissemination of information about the purposes and principles

of forestry and the reasons why forestry is justly to be regarded as playing an important part in these islands.

Educational work in forestry is carried on by means of publications and by addresses delivered before various organizations. In 1907 the monthly journal issued under the direction of the Board, "The Hawaiian Forester and Agriculturist," has been the most important vehicle of publication. In this magazine appear the reports of the Superintendent of Forestry on forest reserve matters, with the recommendations of the Committee on Forestry and the resolutions of the Board in regard thereto, reports on the various phases of the routine work of the Division of Forestry, and numerous special articles on one and another forest subject. During the past four years it has been the custom in each forest reserve report to explain fully the reasons underlying the recommendations made. The object of this is to enable those reading the reports to get intimately in touch with the purpose and ideals of the work. Technical terms are so far as possible avoided and the attempt is made to present the essential facts in a clear and logical manner.

In July the Superintendent of Forestry prepared a statement to be included in the annual report of the Governor of the Territory to the Secretary of the Interior, and in November a paper on the progress of forestry in Hawaii during 1907, which he read at the annual meeting of the Hawaiian Sugar Planters' Association. This paper, with another delivered at the same meeting by Mr. L. A. Thurston, Chairman of the H. S. P. A. Forestry Committee, was later reprinted from the Hawaiian Forester and Agriculturist, as a separate, and distributed. Mr. Thurston's paper is a masterly presentation of the present forest situation in Hawaii. It is one of the notable contributions to the forest literature of Hawaii. It should be carefully read by every one who has to do with the care of forest lands in these islands. Copies may be obtained on application to the Superintendent of Forestry.

On February 28, 1907 there was issued the annual report of

the Board of Agriculture and Forestry for the calendar year 1906. Besides the regular edition of 2500 copies of the full report, 500 copies of the Report of the Division of Forestry were struck off separately. The report was distributed widely in the Territory and to correspondents away from Hawaii.

FUNGUS DISEASE ON MAUI.

Note should be made of a fungus disease that is working serious damage in the forest in the Koolau District on the Island of Maui.

In March 1906, immediately after a severe Kona storm that did considerable damage to the forest, it was noticed that the Ieie vine* and the Ohia Lehua† trees were dying unaccountably. The trouble was confined to spots of varying size. Sometimes the vine succumbed first, sometimes the trees. The trouble was first reported by Mr. W. F. Pogue, the District Forester for the Koolau Section, in his annual report for 1906, under date of January 24, 1907. By April 1907 the existing spots had increased alarmingly and other new ones had appeared in different parts of the forest. There was no apparent cause and no logical relation in the distribution of the infected areas.

On receipt of this information, the Superintendent of Forestry tried to arrange to have Dr. N. A. Cobb, the Pathologist of the Hawaiian Sugar Planters' Association Experiment Station, visit Koolau. But Dr. Cobb was not able to make the trip before leaving the Territory.

The Superintendent of Forestry caused specimens from the diseased trees to be sent to Honolulu for identification of the trouble and, later, visited the area himself. In August, at his recommendation, Dr. H. L. Lyon of the Division of Vegetable Pathology of the Hawaiian Sugar Planters' Association Experiment Station was sent to Maui. Dr. Lyon made a preliminary examination of the forest and reported that the trouble was

---

* *Freycinetia arnotti* Gaud.
† *Metrosideros polymorpha* Gaud.

unquestionably of fungus origin, but that a much more extended examination would be necessary before there could be made a definite statement of the precise cause, or recommendations for feasible means of combatting the trouble. Shortly after this negotiations were begun as a result of which such a study may be undertaken under the auspices and at the expense of the Hawaiian Sugar Planters' Association. A thorough investigation by competent experts in vegetable pathology is essential, for it is a problem where the solution can only be reached after careful study by specialists.

In his annual report for this year, Mr. Pogue notes that the area affected now covers between 4000 and 5000 acres and that the trouble is still spreading rapidly.

One of the pressing needs in Hawaii is that there should be at the service of the people of the Territory a Vegetable Pathologist. Calls requiring the services of such an official are constantly recurring. The specialists at the Hawaiian Sugar Planters' Association Experiment Station are not available except to the plantations and then only for plant diseases affecting sugar cane. The demand is urgent: it should be met.

THE DISTRICT FORESTERS.

Changes in Personnel.

Since the last report several changes in personnel have occurred in the staff of the District Foresters, through change of residence, removal from the Territory and death. A corrected list of the gentlemen now serving as District Foresters will be found elsewhere in this report. To make it of greater use there are included one or two changes that occurred early in 1908, while this report was in preparation.

It is with deep regret that announcement is made of the death on January 13, 1908, of Mr. Frank Scott, District Forester for the District of Koolau, Kauai.

Owing to change of residence resignations have been received from Messrs. A. M. Nowell, Waialua, Oahu; T. S. Kay, North

Kohala, E. E. Conant, South Kohala, David Forbes, Hamakua, and Eric H. Edwards, South Kona, all on the Island of Hawaii.

As successors to the above named gentlemen the following District Foresters have been appointed:

Name	District	Date of Appointment
G. C. Watt,	North Kohala, Hawaii	April 6, 1907
A. W. Carter,	South Kohala, Hawaii	August 5, 1907
R. von S. Domkowitz,	South Kona, Hawaii .	August 5, 1907
W. W. Goodale,	Waialua, Oahu	August 7, 1907
August Ahrens,	West Hamakua, Hawaii...	August 12, 1907

Reports of the District Foresters.

In place of the custom followed in the earlier reports, of a formal contribution from each District Forester, it was decided this year to include the statements made by them in this part of the report. Opportunity was given each District Forester to note anything of special interest that had occurred during the year, or any event in local forest history that had not been recorded before. The replies received show that there is now a widespread interest in forest planting throughout the Territory, especially by the Sugar plantation Companies. The list of Sugar Plantations known to be actively engaged in tree planting is as follows:

LIST OF SUGAR PLANTATIONS IN THE TERRITORY OF HAWAII NOW ACTIVELY ENGAGED IN TREE PLANTING.

Name	Locality
Kauai.	
McBryde Sugar Company	Eleele
Koloa Sugar Company	Koloa
Grove Farm Plantation	Lihue
Lihue Plantation Company	Lihue
Makee Sugar Company	Kealia

Oahu.

Kahuku Plantation Company ..... Kahuku

Maui.

Wailuku Sugar Company ..... Wailuku
Hawaiian Commercial and Sugar Company.....Puunene
Maui Agricultural Company ..... Paia

Hawaii.

Kohala Sugar Company ..... Kohala
Paauhau Sugar Plantation Company ..... Hamakua
Hamakua Mill Company ..... Paauilo
Hakalau Plantation Company ..... Hakalau
Pepeekeo Sugar Company ..... Pepeekeo
Honomu Sugar Company ..... Honomu
Hawaiian Agricultural Company ..... Pahala

On several of the larger Ranches forest planting is also going on; notably the Haleakala Ranch on Maui; the Parker, the Horner, and the Kapapala Ranches on Hawaii; the Honouliuli and the Maunawili Ranches on Oahu; and the American Sugar Company's ranch on Molokai.

On Kauai the work done by Mr. Walter D. McBryde should in particular be noted, for thanks to him not only is tree planting going on on his own lands but also on that of many of his neighbors, in the homesteads and elsewhere.

The following extracts from the reports of the District Foresters are printed here as being of general interest or of importance as a matter of record.

Geo. H. Fairchild—Puna, Kauai.

"The Makee Sugar Company has been planting on its fee simple, side-hill lands and about its laborers' camps the following trees."

Ironwood trees 1498
Koa trees 500

Monkey Pods	300
Japanese Plums	643
Mango trees	50
Alligator Pear	45
Keawi	50
Kukui	100
Strawberry Guava	20
Camphor	100
	3306

"This year it intends to plant about 10,000 Ironwood trees along the windward side of its makai cane fields, bare side-hills and gulches."

Reverend J. M. Lydgate—Kona, Kauai.

Mr. Lydgate sends a memorandum of trees planted in the Koloa District as follows:

McBryde Sugar Company	20000
Koloa Plantation	8000
Scattering	2000
	30000

John Herd—Koolaupoko, Oahu.

"I beg to submit a report on Forestry conducted on the Maunawili Ranch during the calendar year 1907.

"Trees Planted Out During Above Period:

Albizzia Moluccana	350	trees.
Grevillea Robusta	345	"
Olives	43	"
Rubber (Hevea, Ceara & Castilloa)	512	"
Total	1250	

"Further large plantings of Rubber trees have since been made and will be continued from time to time.

"We have cut down and destroyed by fire over five hundred dead or dying Alligator Pear trees. These were all matured

trees which had evidently been first attacked by a root fungus. Although an interested observer would at the outset have taken these Alligator Pear trees to be in a healthy condition they were far from being so on account of the root fungus attack before mentioned. Numerous small borers attacked the trunks and larger branches just as soon as the trees showed any sign of being unhealthy or in a fit condition for their depredations, eventually killing them outright in the course of a few months. We have altogether planted out on this Ranch 4,627 Alligator pear trees and it looks at the present time as if we might eventually lose the entire lot, even three year old trees being attacked by the disease and the borer.

"Our coffee crop has for a number of years been attacked by a black fungus which destroys the berry while ripening, causing a loss of over twenty-five per cent; this season the fungus has not spread as in former years. The introduction here through the Board of Agriculture of a small parasite which has destroyed the eggs of the Torpedo bug in large numbers was supposed by me to be the reason for the disappearance this year of the berry fungus in question, as the Torpedo bug when in large numbers appeared to attack the coffee berry as well as the leaf. Whether or not my supposition is correct the fact remains that the Torpedo bug has diminished to an enormous extent because of the attack of its egg parasite above referred to. The parasite referred to was I believe introduced from Australia into Hawaii by Prof. Koebele about two or three years ago for the specific purpose of destroying the eggs of this torpedo bug."

W. F. Dillingham—Ewa, Oahu.

"The John Ii Estate is doing some tree planting on the upper lands near their mountain house. The Hawaiian Pineapple Company is making ready to plant about twenty acres of land in upper Waipio and not far from the mountain house of the Ii Estate. This planting will consist principally of Eucalyptus Globulus, Eucalyptus Robusta and Eucalyptus Rostrata. While this above referred to planting is experimental in nature, the wood will be used in time for supplying the pineapple camps with firewood.

"Along the westerly slopes of the Koolau Range on the lands owned by and under lease to the Oahu Railway and Land Com-

pany the forest is making slow but steady growth of new trees. The ridges in this locality are practically impassable half a mile above the mountain fences due to the underbrush, thick rice and hilo grass and young trees, all of which together give the ground a covering which is a step in the right direction.

"Along the Waianae Range very good results are observed for the year 1907. The dying off of the lantana, however, has opened up a large tract of mountain land, which had practically fenced off the cattle from the young forest which was strating up above the lantana belt. Forestry work is being continued by the Railway Company along the tops and slopes of the south-westerly end of the Waianae Mountains, several thousand new trees having been set out this winter. A good growth of young Koa is coming up from old roots. The Algaroba, which has always been considered a low land tree, is spreading towards the mountain top and on the higher elevations seems to have changed in character so as to now grow with thrift at a height of 1500 feet. The south-westerly slopes of the Waianae Mountains are rapidly being covered by this growth of trees.

"A systematic hunting of goats on the Waianae Mountains has resulted in the saving of considerable old forest cover. In this connection I have to say that it would be a most advantageous move to have the goats driven or hunted off all of the lands extending to the mountain tops as the driving of the animals from the Railway lands means devastation of the adjoining lands to which the goats go.

"I am pleased to report that there have been no forest fires in the district during the year 1907. More and more interest is shown in the cause of reforesting the mountains by the land owners of this district."

Andrew Adams—Koolauloa, Oahu.

"Appreciating the probable shortage of lumber in the future, Kahuku Plantation Company is systematically planting Hau in the fences by placing Hau cuttings at points equidistant from the fence posts in the line of fence, so that when the present fence posts become useless the wires can be attached direct to the Hau bushes. This, of course, serves a double purpose and presently the line of fence along the government road through the plantation will be filled with Hau trees. This is being done

not only along the government road but along the entire line of plantation fences."

Mr. William F. Pogue—Koolau, Maui.

"The death of the forest trees, caused by some, as yet unknown disease, has spread very rapidly, the estimated area being between 4000 and 5000 acres, and the destruction of the live forest in this district continues even more rapidly than a few months ago. Unless something is found to prevent this epidemic before long, it will only be a few years before the original forest trees here will be extinct."

Mr. L. von Tempsky—Makawao, Maui.

"There have been planted on the Haleakala Ranch during 1907, between thirteen and fourteen thousand trees; all (with the exception of 850 which outline a fence) in plots, varying from one to thirteen acres.

"I am planting exclusively the seeds of valuable Eucalypti, such as E. Amygdalina, Botryoides, Corymbosa, Corynocalyx, Leucoxylon, Paniculata, Rudis, Gunii, Siderophoia, Sieberiana, Polyanthemos and Rostrata; all of these are trees of known value for fence posts, railroad ties, bridge and wharf timbers.

"I find the Botryoides the most rapid grower, equalling, and in some cases beating the Globulus. As this species ranks very highly in Australia for railroad ties, I am sure that one cannot go very far wrong in planting lots of it. Next in rapidity of growth comes the Rudis, which seems entirely suited to Makawao soil and climate. I am experimenting with cost of tree growing under different conditions. In one case I have planted a measured acre, furrowed and kipikuaed* only; immediately adjoining it, is a plot of three acres, plowed, harrowed, and the soil thoroughly prepared. In both cases identically the same species are planted, in two or three instances half a box of trees would be planted in the one acre lot, and the other half in the three acre piece; the effort being made to have the specimens in both lots as nearly alike in size and vigor, as possible.

* Kipikua is the local name for pick-mattock.

"At present the difference in growth of the two lots is wondedful, the cultivated trees being more than three times as tall as the uncultivated; at the present age of these trees (six months) some of the Botryoides measure 7 ft. 3 in. high, the Rudis 6 ft. 6 in. A stray Globulus that managed to get in one of the boxes and was planted measures 6 ft. 3 in. I am keeping careful figures on the cost of these two lots, and will be able to give you some data as to the difference between the two styles of cultivation next year.

"In order to reduce the cost of the three acres, I have planted between the tree rows (which are six feet apart) Irish potatoes, and with any luck at all, I will probably clear the outlay expended on both the trees and potatoes; and as the potatoes are being constantly hoed and hilled up I believe that the stirring of the soil will stimulate the tree growth sufficiently to offset any detriment that may be caused by the use of the soil.

"During the past year I cut 244 good fence posts, five to twelve inches in diameter, from 38 second growth Eucalyptus Rostrata trees, twelve years old. Some of these posts have been put in the ground plain and the balance subjected to Creosote treatment by the Kahului Railroad Company. All of these posts will have the date stamped on them, and the place of use recorded in the ranch forestry book; so that it can be ascertained accurately their respective life in the ground."

Mr. George C. Watt—North Kohala, Hawaii.

Mr. Watt reports that the Kohala Sugar Company has been planting up its waste land and gulches, principally with Ironwood (*Casuarina equisetifolia*).

Mr. John M. Ross—North Hilo, Hawaii.

Mr. Ross reports the planting of a wind-brake along the bluff by the Hakalau Plantation Company; considerable tree planting by the Homesteaders on the different settlement association tracts, both at Hakalau and Honomu; and the planting by the Pepeekeo Sugar Company of about ten acres of Pride of India trees.

Mr. J. Watt—Puna, Hawaii.

"It may not be out of place to mention here that a small area of forest land in Puna has been cleared and planted to Rubber by a Company of Honolulu men. I have not seen the trees but I am informed that they are growing well.

"The Hawaiian Mahogany and Lumber Company are erecting a saw mill near the Pahoa station in connection with the lumbering operations which they are to carry on on the lands of the Puna Sugar Company. So far they have not cut any trees but expect to do considerable work during the present year. All of the land to be lumbered by the above company will be planted to cane."

Mr. J. A. Maguire—North Kona, Hawaii.

Mr. Maguire calls attention to the increasing interest that is being taken in North Kona due to the establishment of the Hawaiian Development Company in that District.

THE WILD BIRD LAW.

Pursuant to Act 104 of the Session Laws of 1907, "to provide for the protection of birds beneficial to the forests of the Territory of Hawaii," thirty-five of the District Foresters were commissioned as Special Territorial Police Officers by the High Sheriff of the Territory. Those so appointed are designated by a star (*) in the list of District Foresters.

The full text of the Bird Law is given on another page of this report. As a matter of record it may here be noted that Prof. H. W. Henshaw, now of the Bureau of Biological Survey of the United States Department of Agriculture at Washington, but for some years a resident of this Territory, has suggested that this law should be so amended as specifically to cover the Hawaiian Goose (Nene). Dr. Henshaw says, "If there is any Hawaiian bird that deserves special protection it is the Hawaiian Goose, both because it is unique, it having no near relative elsewhere in the world, and because of its economic importance as food." The law should be amended to include it.

TANTALUS AND NUUANU FORESTS.

It may be noted that the Coney Estate lands on Tantalus Heights, Oahu, on which is the greater part of the planted Eucalyptus forest, passed to the Territory as a part of the Lanai Exchange. But as the Lanai case has not yet finally been settled by the Courts, the Government has refrained from taking active control. By agreement with the Superintendent of Public Works the management of the Forest on Tantalus is turned over to this Department. At present the care given consists mainly in the protection afforded by the presence of the Forest Ranger. Tantalus Forest and Tantalus Heights are really to be considered as a Forest Park. Consequently among the other duties of the Forest Ranger are the keeping open of old trails and the construction of new ones. Trails would facilitate the fighting of fire should one ever happen to occur: they add much to the enjoyment of Tantalus as a park.

During the year the Division of Forestry has continued to keep men in upper Nuuanu Valley to look after the young trees and to do other necessary work. The Nuuanu Forest plantations continue to thrive and increase in value and attractiveness.

FOREST FIRE SERVICE.

Hawaii has been fortunate during the past year in the absence of meteorological conditions favorable to forest fire. The presence on the statute books of the present forest fire law has doubtless also had something to do with the small number of fires. Fire warning notices in different languages are posted generally throughout the Territory, and many of the District Fire Wardens have been active in calling to the attention of the people in their districts the penalties provided where injuries result to the forest from the careless use of fire.

PERIODS OF FOREST FIRE DANGER.

Special periods of forest fire danger were proclaimed in two cases, under the authority of Section 6 of Act 71 of the Session

Laws of 1905, as follows: For Tantalus Heights, Oahu; twelve months from February 9th, 1907; and for a portion of the District of Waialua, Oahu, six months from March 19, 1907, number of permits to burn brush, eleven.

On Tantalus Heights, Oahu, because of the great danger resulting from the large number of persons visiting the forest, a special period of twelve months is annually declared in February. During the year thirty permits to burn brush were issued by the District Fire Warden in charge, Mr. W. M. Giffard. One of the important duties of the Forest Ranger on Tantalus is to see that the work authorized in these permits is properly done.

RECORD OF FIRES.

Three small brush fires, all of which were promptly extinguished, were reported to the Chief Fire Warden during 1907. The record is as follows.

May 30, Waiakea, Puna, Hawaii.

Grass fire. Area burned over, about 100 acres. No damage; but had the fire not been stopped it would probably have reached the forest, with serious consequences.

At the request of the District Fire Warden, Mr. J. A. Scott, the Deputy Sheriff, Captain Fetter, turned out the prisoners in the Hilo jail and extinguished the fire. It was impossible to secure any evidence as to the persons who set the fire.

June 30, Nuuanu Valley, Honolulu, Oahu.

Brush fire on the Waikiki side of Nuuanu Valley, opposite the Forester's cottage. Area burned over, about 15 acres. Damage slight. This fire was extinguished after five and a half hours hard work by the Deputy Fire Warden for Nuuanu Valley, Mr. G. H. Moore, assisted by his daughter Mary, and one laborer.

Summer, 1907, Koolauloa, Oahu.

Mr. Andrew Adams, the District Fire Warden, reports one brush fire, resulting from the careless use of fire, in the clearing of land. The fire was stopped before any real damage was done.

Lack of Money for Fighting Forest Fires.

The Department is seriously hampered in its efforts to combat forest fires by the absence of any fund from which fire fighters can be paid. This past year the Territory has been fortunate in generally favorable climatic conditions. Next year there may be a long drought. Provision should be made for a fund that could be drawn on should an emergency arise. An effort to secure such a fund will again be made at the next session of the Legislature.

FORESTRY IN GENERAL.

Outside of the forest work carried on by the Territorial Government and of the tree planting on the Sugar Plantations—of which mention has already been made—there are to be noted the following facts of forest interest in Hawaii during 1907.

THE LUMBER INDUSTRY.

Hawaiian Mahogany Lumber Company.

The development of the Hawaiian lumber industry stands out preeminent, through the signing in October 1907 of a contract between the Hawaiian Mahogany Lumber Company and the Santa Fe Railway System to supply during the next five years ninety million feet, board measure, of Ohia Lehua railroad ties; eighty million feet in the form of 500,000 standard ties annually, and ten million feet in 2,500 sets of switch ties.

In September 1907 Mr. E. O. Faulkner, Chief of the Bridge and Tie Timber Department of the Santa Fe Railway came to Hawaii on his way around the world in the interests of his com-

pany. The contract was signed after a visit to the forests on the Island of Hawaii. This contract is far reaching in its effect for it introduces our Ohia timber to the mainland market. Once known it cannot in the furture ever wholly be lost sight of, especially with the growing demand for hardwood timbers of the better sort.

Most of the ties for this contract will be cut in the Puna District on the homestead lots above Olaa, on lands of the Puna Plantation that are being cleared for cane, and on other lands in Puna on which rubber will be planted. The ties will be shipped from Hilo by steamers and sailing vessels, the first shipment being some time in the spring of 1908.

Prior to this contract—in June 1907—one schooner load of 13,000 Ohia ties was sent to San Francisco. Several good sized orders for Ohia ties and Ohia piling for use in the Territory have also been filled by the Hawaiian Mahogany Lumber Company.

In its work with Koa the Hawaiian Mahogany Lumber Company is progressing slowly. A narrow gauge railroad is being built from Glenwood to the saw-mill in the woods back of the Volcano House, the mill itself has been erected and some of the machinery installed. Some 200 or 300 large Koa trees have been felled, cut into logs and hauled in to the mill yard. The practice of pulling the trees over by cable and donkey engine, instead of felling them is the usual way with ax and saw, has been proved practicable. This is an important point to have settled, as this method will result in a saving of waste at the butt which when the log is sound, is the most valuable part of the tree. If the program outlined by the Company is carried out a considerable quantity of high grade Koa lumber should soon be on the market.

American-Hawaiian Mahogany Lumber Company.

The operations of the American-Hawaiian Mahogany Lumber Company in South Kona are also slow in developing. A well

built wagon road has been constructed from the Buchholtz Place up to the Logging camp in the Koa Belt, which permits the hauling of logs by wagon to the landing at Hoopuloa. One shipment of Koa logs, of approximately 30,000 feet, board measure, was made in October 1907. The logs went by schooner to the Company's mill at Petaluma, California. No Ohia has been cut by this Company.

Hawaiian Development Company.

Mr. J. B. Castle, under the name of the Hawaiian Development Company, has large plans for the general economic development of the Kona District. A railroad is projected, connecting at Kaawaloa Point with ocean going steamers that can tie up to a wharf to be built in deep water. To provide an immediate supply of freight for the new railroad it is proposed that extensive lumbering, both of Koa and of Ohia be begun in the Kona forests. As a result options have already been secured on several tracts. Other applications are pending, among them one from Mr. Castle for such stumpage on all the Government forest lands in the Kona district as the Territory may be ready to sell under restrictions looking to the continued welfare of the forest.

The options that have been given so far provide that the lumbering be done in accordance with the methods of practical forestry: the other large private owners and the Territorial Government will protect their interests still more carefully, in any contracts that may later be made.

As has already been pointed out in this report large areas in the forest of Kona and Puna belong to the commercial forest class, where the wise use of the forest is judicious exploitation. Under scientific management the Hawaiian forest of this class can be made to yield repeated crops of wood and timber, while being constantly improved in quality. Much of the upper land in Kona is unsuited to raising any crop but trees well. If it is used for other purposes say for grazing, it is at best of only

indifferent value. This makes it obvious that as the Kona forest is not needed to protect water sheds it should be turned to economic account in some other way. Therefore, provided that the lumbering is carried on in accordance with the methods of forestry, its advent as an industry in Hawaii is heartily to be welcomed.

RUBBER.

Another sign of much promise in Hawaii is the steady development of Rubber as an industry. It is true that until systematic tapping tests, conducted at Nahiku, show that the latex flows in sufficient quantity to permit it to be collected at a profit, the industry will still be in the experimental stage. But there is every indication that the outcome will be successful. The trees grow well and it is reasonable to expect that ordinary difficulties in regard to methods of tapping and cultivation can be overcome. The summer of 1908 will see such tests regularly begun at Nahiku.

On October 12, 1907, there was organized at Nahiku, Maui, the Hawaiian Rubber Growers Association. A good sized company of people went over from Honolulu on a special steamer; the four Maui rubber plantations were visited; and at the dinner following the organization of the Association, papers were read and speeches made by various men prominent in the Territory. The object of the Association is to bring the Hawaiian rubber growers together and in general to advance the industry.

In October 1907, Mr. F. T. P. Waterhouse started on a trip to inspect the rubber plantations in the Malay Peninsula. In order that he might also visit Ceylon, Mr. Waterhouse was appointed a Special Agent of the Board of Agriculture and Forestry, a portion of the expenses of the trip being paid by the Territory. As a result the Board will secure a report on the methods of growing and harvesting rubber in use in those countries, that cannot but be of much value. The report will of course be published in due time.

COCONUTS.

The manufacture and shipment of a considerable quantity of copra from the Island of Kauai, the organization of a company to start a coconut plantation on the windward side of Oahu, and the planting of numerous small groves on the other islands all point to the development of a coconut industry. The Hawaiian islands lie just at the northern edge of the zone in which the coconut will thrive, but the demand for coconut products—coconut oil, copra, and coir—is so great that the outlook is full of promise. In Hawaii it takes from seven to ten years for a coconut grove to come into bearing, but as this group of islands is free from the severe storms that at intervals do so much damage in the South Seas, Hawaii is able to compete successfully with regions more favorably located for coconut growing.

ARBOR DAY.

Arbor Day has now become a recognized festival in the schools of Hawaii. This year, Friday November 15 was the day appointed by the Governor. This date is a better one than the first Friday in November, because it removes the possibility of conflict with the Japanese Emperor's birthday—a date of considerable significance locally, on account of the large proportion of Japanese children in the Hawaiian public schools—and because it brings the planting a little more directly under the favorable influence of the winter rains.

THE OUTLOOK FOR 1908.

An annual report necessarily consists largely in a retrospect of past endeavor. It is a record of things accomplished or, at least, actually begun. It should also contain an outline of future work.

During 1908 it will be the aim of the Division of Forestry to bring to completion and final setting apart practically all of

the large forest reserves that are needed to establish the main chain of the forest reserve system throughout the Territory.

An earnest effort will be made to encourage further and on a larger scale than at present, tree planting on waste land by private individuals and corporations.

The work of introducing new trees of economic value will be continued; the distribution of the exotic plants now being propagated will be begun. Assurances have been received from the United States Forest Service that in 1908 provision will be made for cooperation between that Bureau and this Territory in experimental tree planting on the upper slopes of the high mountains. It is hoped that this important work can surely be started during the coming year.

In anticipation of the next Session of the Territorial Legislature steps will be taken to secure favorable action on an increase in appropriation sufficient to provide for the fencing of certain forest reserve boundaries, for the employment of forest rangers, and for a fund for use in emergency, for combatting forest fires.

There are many forest problems waiting to be attacked in Hawaii. A thorough investigation of the areas of planted forest throughout the Territory would yield an immense amount of valuable information as to the rate of growth, amount of wood produced, and relative worth of the introduced trees. A detailed study of the habits of the Native Hawaiian trees would from the basis for perfecting the most efficient methods of handling the forest reserves. The repeated observation, at intervals, of given tracts that have been lumbered, or burned over, or fenced off from cattle would throw additional light on the difficult problem of how to put all of the forested area of Hawaii to its wisest use.

These are some of the opportunities for service that lie before the Division of Forestry. The year 1907 has seen the establishment under auspicious conditions of several enterprises of importance in the forest history of Hawaii. The year 1908

should show long steps of progress in the development of these and other forest projects.

Very respectfully,

RALPH S. HOSMER,

Superintendent of Forestry and

Chief Fire Warden.

Report of the Forest Nurseryman.

Honolulu, Hawaii,
December 31, 1907.

Ralph S. Hosmer, Esq.,
Superintendent of Forestry,
Honolulu, Hawaii.

Dear Sir:—

I herewith submit a report of the work done at the Government Nursery, the Nuuanu Station and the Tantalus Forest, including the giving of advice and assistance and other matters, for the year ending December 31, 1907.

THE NURSERY.

COLLECTION AND EXCHANGE OF SEED.

The collection of seed has been continued throughout the year and one man has been kept busy collecting and making up packages for exchange purposes. Our seed exchange list now numbers 110. In opening communications regarding the exchange of seed a circular letter was drawn up and forwarded to 110 addresses, including all the known Botanic Gardens in different parts of the World, also a number of Forest Departments, Experiment Stations, Parks, and other Institutions. The full list is given on another page of this report.

To each was sent sample packages of seed collected in the neighborhood of Honolulu. The average number of packages sent to each was about 50, representing as many species and varieties. Altogether 5453 packages were sent out. In exchange for seed sent out we have already received 925 packages, a large number of which are new to the Islands.

From the Botanic Gardens, Dahlem, Berlin, Germany we received two new kinds of rubber bearing Manihot; one des-

cribed as coming from Jequie and the other from Piauhy, Brazil. About 25 plants of each kind were raised from the seed received; these are doing well.

A large number of plants new to the Territory are being raised from the seed received, and a piece of ground is being prepared in Makiki Valley for the purpose of experimenting with them. The plants that are found to be of value and grow well will be increased by seed and cuttings and in time distributed to people who guarantee to take good care of them. Mr. Marston Campbell, Superintendent of Public Works, kindly granted the Board the use of the land upon which the new plants are to be tried.

CONGRESSIONAL VEGETABLE SEED.

The usual consignment of vegetable seed was received from the Honorable J. K. Kalanianaole and distributed to people all over the Territory, including all the public and private schools. A large number of homesteaders and others applied for seed by letter and quite a number called at this office in response to a free advertisement in the local newspapers.

GROWING AND DISTRIBUTION OF PLANTS.

Owing to the large quantities of seed of new plants which we are receiving through the exchange system, it was found that the small propagating house was not large enough for the work. A new propagating house the same size as the other one was accordingly built. Both houses are fitted up with ant-proof supports made of concrete. Another feature of the houses is a new system of watering from the bottom. This is done by means of zinc covered benches made in the shape of a large tray, the dimentions being four inches deep and three feet by fifteen feet. Each house has two benches with a three foot gangway between. A faucet is placed at one end of each bench to supply the needed water. At the other end a $\frac{3}{4}$ inch pipe is connected with a

groove which runs along the center from the one end to the other. There is a gradual fall of about one inch on the groove, the bench otherwise being level. This system of watering works exceedingly well and better results have been obtained since its inaguration than we have had at any time in the past.

The following is the number of plants given away, sold, and sent out for Arbor Day planting—also gratis—to Homesteaders, Improvement Clubs, Schools, Parks and others.

	Forest	Fruit	Ornamental	Total.
Gratis	2982	580	4102	7664
Arbor Day	654		870	1524
Sold	7050	310	3555	10915
	10686	890	8527	20103

In addition to the above, 5,000 Para rubber (*Hevea brasiliensis*) trees were propagated from seed for the Castle Estate and 3,000 of the same kind for Maunawili Ranch.

REALIZATION.

During the year there has been collected and deposited with the Treasurer of the Territory, as a Government realization, the sum of $347.15. The amount is itemized as follows:

Sale of plants	$263.00
Sale of seed	28.20
Receipts for fumigating plants (Division of Entomology)	14.95
Receipts for Insect Boxes (Division of Entomology)	40.50
Rebate on Post Office Box	.50
	$347.15

RUBBER.

During the month of June, 186 Central American Rubber Plants (*Castilla lactiflua*) were distributed. These were raised

from seed received from Ceylon. Twenty-five people were selected on the different Islands who agreed to plant and take care of the trees. As a matter of record a list of those to whom these rubber trees were sent follows this report.

In addition to this about 300 trees of the same kind were raised. The seed from which they were propagated was brought from Mexico by Mr. G. R. Ewart and propagated for him at the Nursery. At the request of Mr. Ewart a circular letter was drawn up, and a copy sent to each of the plantation managers. The letter stated that a limited number of plants could be had by applying for the same at this office. A large number of the managers took advantage of this offer and sent for plants.

Ceara Rubber.

Favorable reports have been received from a large number of people in different parts of the Islands regarding their success with the seed of the Ceara Rubber (*Manihot glaziovii*) sent out from this office for experimental purposes, during the months of June and July 1906. One hundred persons were selected to take up the work of experimenting with this Rubber on the different Islands of the group. A great many of these have made favorable reports regarding the growth and healthy condition of the trees.

NURSERY GROUNDS.

Considerable work has been done in improving the Nursery Grounds. A large quantity of soil has been carted in to fill up to grade the low lying part in the center, about 3000 yards of soil being required. The walks have also been filled up to grade with coral rock. Redwood curbing has been laid along all the walks. Through the kindness of Mr. C. S. Holloway, the then Superintendent of Public Works and Mr. Marston Campbell, the present Superintendent of Public Works, enough soil for filling purposes has been secured and delivered at the Nur-

sery without cost to the Board. We are also indebted to Sheriff Henry for his kindness in allowing us the use of two prisoners. the prisoners have worked exceedingly well and we have had no trouble whatever with them.

ADVICE AND ASSISTANCE.

HAWAII.

Puna Sugar Company.

Examination and report on two tracts of land in the District of Puna, belonging to the Puna Sugar Company and known as Kamaile tract and Keahealaka tract.

The visit and examination was made at the request of the agents of the Puna Sugar Company and was for the purpose of studying on the ground the local conditions in regard to the advisability of starting rubber planting on a large scale. The planting of experiment plots at different elevations with the following rubber trees was recommended. Para rubber (*Hevea brasiliensis*), Central American rubber (*Castilla lactiflua*) or (*Castilloa elastica*), Ceara rubber (*Manihot glaziovii*).

OAHU.

Waialee Industrial School.

A report with recommendations on the reforesting of certain lands belonging to the Industrial school at Waialee, Oahu.

The examination was made at the request of T. H. Gibson, Superintendent, and was for the purpose of making recommendations in regard to the best trees to plant, methods of planting, etc. Recommendations were made with a view to the needs of the institution as regards trees for firewood, fence posts, etc.

Waialua Plantation.

Report with recommendations on the reforesting of part of what is known as Kawailoa Tract, belonging to Waialua Plantation.

The examination and report was made at the request of Mr. W. W. Goodale, Manager, and was for the purpose of studying the local conditions in regard to tree planting of a 2000 acre tract. Black Wattle (*Acacia decurrens*) was recommended for this tract.

Catholic Mission Lands in Kalihi Valley.

Report with recommendations in regard to the planting of forest and other trees on a tract of land in Kalihi Main Valley, belonging to the Catholic Mission.

The examination and report was made at the request of Bishop Libert and was for the purpose of giving advice on the planting of forest and other trees best suited to the needs of the institution. A number of trees were recommended.

Wahiawa Water Company.

Report with recommendations on the removing of dead trees and the replanting of a tract of land at Wahiawa.

This tract is part of the forest which was destroyed by fire during the month of March, 1905. The Wahiawa Water Company lease the water rights on this land and their main ditch runs through it. A planting plan was drawn up for this tract. The examination and report was made at the request of the Agents of the Company.

Hawaiian Fibre Company.

Report with recommendations on the planting of trees on certain lands lately acquired by the Hawaiian Fibre Company at Lower Pouhala.

The examination and report was made at the request of Mr. Wm. Weinrich, Manager, and was for the purpose of making recommendations in regard to the planting of trees in the gulches and other land not wanted for sisal growing. A number of trees producing valuable timber were recommended.

Waianae Uka, Ewa District.

Report with recommendations on a tract of forest land known as part of the burned section of Waianae Uka, Ewa District; and in regard to the removing of dead trees and planting with other trees.

The examination and report was made at the request of the Agents of the Dowsett Company and was for the purpose of making recommendations regarding the removing of the dead trees on the tract and planting with other trees. A plan similar to the one made for the Wahiawa Water Company was recommended.

MAUI.

Kaupo, Maui.

Report with recommendations on certain tracts of land belonging to Mr. D. B. Murdock and Mr. E. E. Paxton in the district of Kaupo, Maui.

The examination was made at the request of Messrs. Murdock and Paxton and was for the purpose of making recommendations regarding the advisability of using the tract for rubber or other industries.

After a thorough examination of the tract the growing of pineapples was recommended as the principal crop. In the gulches patches of limes and oranges were recommended.

IN AND AROUND HONOLULU.

The number of people in and around the city who have asked for advice and assistance has been larger during the year

than at any time in the past. Forty-five visits have been made and a large number has called at this office. The nature of advice and assistance asked for principally concerns the planting and care of trees, pruning, preparing of the soil for seed raising and so forth.

NUUANU STATION.

The condition of the forest is exceedingly good. Since the last annual report the increase in the growth of the trees is very noticeable. The two men at the station have spent most of their time in fighting the vine, Maile Pilau. This work will require to be kept up and if possible not only the planted part attended to but the larger trees of indigenous growth, such as Koa, Kukui and Ohia growing higher up the slopes. An effort will be made during the coming year to clear this vine from all trees of any value.

TANTALUS FOREST.

The Tantalus forest is also in good condition, the trees being healthy and growing well. The Ranger, David Kapihe, has done good work in clearing trails and looking out for fires. No sales have been made. The percentage of trees that have died is very small.

Respectfully submitted,
DAVID HAUGHS,
Forest Nurseryman.

LIST OF PERSONS TO WHOM WERE SENT EXPERIMENTAL LOTS OF CENTRAL AMERICAN RUBBER.

(*Castilla lactiflua*)

	Number of Plants
Hind, R. H., Puuwaawaa Ranch, Kawaihae, Hawaii	6
Holstein, Hon. H. L., Kohala, Hawaii	6
Iten, Henry, Mountain View, Olaa, Hawaii	6
Lee, Peter, Kurtistown, Olaa, Hawaii	6
Loebenstein, D. A., Wainuinui, Puueo, Hilo, Hawaii	6
Lyman, Henry, Kapoho Ranch, Puna, Hawaii	6
Lyman, L. C., Hilo Boarding School, Hilo, Hawaii	6
Matthias, Brother, St. Mary's School, Hilo, Hawaii	6
McDougall, Geo. W., Hookena, Kona, Hawaii	6
Paris, Hon. J. D., Kealakekua, Kona, Hawaii	6
Snow, Frederick, Mountain View, Olaa, Hawaii	6
Domkowitz, R. von S., Hoopuloa, Kona, Hawaii	6
Webster, Frank L., Pahoa, Hawaii	12
White, T. C., Kealakekua, Kona, Hawaii	6
Gay, Francis, Makaweli, Kauai	6
Hudson, C. W., Wainiha, Kauai	6
McBryde, Walter D., Koloa, Kauai	6
Wilcox, Hon. G. N., Lihue, Kauai	6
Anderson, W. A., Nahiku, Maui	12
Austin, C. J., Nahiku, Maui	24
Howell, Hugh, Nahiku, Maui	12
Pogue, W. F., Huelo, Maui	6
Searle, R. C., Honolua, Maui	6
Munro, James, Molokai Ranch, Molokai	6
McVeigh, Jack, Leper Settlement, Molokai	6
Total	186

EXCHANGE LIST.

INTRODUCTION OF EXOTIC SEED AND PLANTS.

United States.

Arnold Arboretum, Jamaica Plain, Mass.
Botanical Gardens, Pennsylvania Avenue, Washington, D. C.
Botanical Laboratory and Garden, Johns Hopkins University, Baltimore, Md.
Briton, Dr. N. S., Director New York Botanical Garden, Bronx Park, N. Y.
Desert Laboratory, Tucson, Arizona.
Franceschi, Dr. F., Santa Barbara, California.
Goodale, Dr. George Lincoln, Director, Harvard Botanical Gardens, Cambridge, Massachusetts.
Gray, Robt. M., Superintendent Harvard Experiment Station, Soledad, Cienfuegos, Cuba.
Office of Seed and Plant Introduction, U. S. Department of Agriculture, Washington, D. C.
Trelease, Dr. Wm., Director, Missouri Botanical Gardens, St. Louis, Mo.

Foreign Countries.

A.

Curator, Botanical Station, Uganda, British East Africa.
Dunga Experiment Station, Zanzibar, British East Africa.
Imperial Biological Agricultural Institute, Amani, Port Tonga, German East Africa.
Director of Agriculture, Zanzibar, German East Africa.
Botanical Station, Alburi near Accra, Gold Coast, Africa.
Natal Botanical Garden, Durban, Natal, South Africa.
Botanic Gardens, Sierra Leone, West Africa.

Museo de la Plata, Buenos Ayres, Argentine Republic.
Jardin Botanique de la Univ. de Cardoba, Argentine Republic.

Botanic Gardens, Port Darwin, Australia.

Dixon, Hugh, Esq., Abugeldu Summer Hill, Sydney, New South Wales, Australia.

Forest Department, Sydney, New South Wales, Australia.

Staer, J., F.L.S., Nurseryman and Seeds-man, Wahroonga, New South Wales, Australia.

Bailey, Dr. Frederick Manson, F.L.S., Colonial Botanist, Brisbane, Queensland, Australia.

Bartels, O., Brisbane, Queensland, Australia.

Acclimatization Society Gardens, Brisbane, Queensland, Australia.

Botanical Gardens, Brisbane, Queensland, Australia.

Botanical Gardens and Government Plantations, Adelaide, South Australia.

Suehmann, Dr. J. G., Government Botanist, Melbourne, Victoria, Australia.

Woods and Forest Department, Perth, West Australia.

B.

Jardin Botanique, Brussels, Belgium.

Botanical Station, Bermuda.

Jardin Botanico, Rio de Janeiro, Brazil.

Botanical Gardens, Sao Paulo, Brazil.

Public Gardens, Rio de Janeiro, Brazil.

Museo Parence de Historia Natural, Para, Brazil.

Baker, C. F., Esq., Curator Herbarium and Botanical Gardens, Museo Goeldi, Para, Brazil.

C.

Superintendent Gardens and Public Parks, Cape Town, Cape Colony.

Royal Botanical Gardens, Peradeniya, Ceylon.

Jardin Botanico Y Catedraties de la Univ. Ydal Inst. Naceonal, Santiago, Chili.

Botanic Gardens, Hongkong, China.

Director of Agriculture, Forests and Commerce, Hanoi, Cochin China.

Botanical and Afforestration Department, Botanical Gardens, Hongkong, China.

Jardin Botanique, Saigon, Cochin China.

Kinsman, C. D., Nauvitas, Cuba.

E.

Royal Botanic Gardens, Kew, England.

F.

Botanical Station, Fiji.

Jardin Botanique, St. Denis, Rouen, France.

Robertson, A., Proschowsky, St. Helene, Nice, France.

G.

Station Agriculture di Missoloughi, Athens, Greece.

Agricultural Experiment Station, Agana, Guam.

Botanical Gardens, Georgetown, British Guiana.

H.

Honduras Botanical Gardens, Patuca, Honduras.

I.

Government Gardens, Allahabad, India.

Lloyd Botanical Gardens, Darjeeling, Bengal, India.

Victoria Nursery, Calcutta, India.

Royal Botanic Gardens, Calcutta, India.

Union Nursery, Darbhanga, India.

Biharilal's Garden, Horobagh Jubbulpore, India.

Barber, Dr. Chas. A., Government Botanist, Chepauk, Madras, India.

State Gardens, Morris Kathiawas, India.

State Gardens, Baroda, India.

Government House Gardens, Kirkee, Bombay, India.

Horticultural Society's Gardens, 17 Alipur Road, Calcutta, India.

The Superintendent Memorial and other Public Gardens, Cawnpur, U.P., India.
" " Historic and other Gardens, Delhi, Punjab, India.
" " Botanical Gardens, Kumaon, U.P., India.
" " Agricultural Horticultural Gardens, Lahore, Punjab, India.
" " Historic and other Gardens, Lahore, Punjab, India.
" " Horticultural Gardens, Lucknow, U.P., India.
" " Agricultural Horticultural Gardens, Madras, India.
" " Maharaja Bagh and other Gardens, Nagpur, Central Provinces, India.
" Curator, Government Gardens and Parks, Ootacamund, Madras, India.
" Superintendent, Pyzabad Park and Gardens, Pyzabad, U. P., India.
" Botanic Gardens, Travancore, India.
" Superintendent, The Taj and other Gardens, Ugra, U.P., India.

Mysore Botanical Gardens, Bangalore, Mysore, India.
Botanical Department, Laharanpur, N. W. Province, India.
Botanic Agricultural Gardens, Penang, India.
Botanical Gardens, Saharupur, Province of Agra and Oudh, India.
Royal Botanical Gardens, Sibpur near Calcutta, India.

J.

Botanical Department, Kingston, Jamaica.
Botanical Gardens, Kingston, Jamaica.
Sapporo Agricultural College, Sapporo, Japan.
Botanical Gardens, Imperial University, Tokio, Japan.
Yokohama Nursery Company, Yokohama, Japan.
Botanical Gardens, Buitenzorg, Java.
Government Botanical Gardens, Buitenzorg, Java.

M.

Experimental Stations, Salangor, Federated Malay States.
Department of Forests and Botanical Gardens, Pamplemoussees, Mauritius.

N.

Colonial Botanic Gardens, Napier, New Zealand.
Cokayne, L., Island Bay, Wellington, New Zealand.

P.

La State University, Batin Rouge, Peru.
Estacion Experimental, Lima, Peru.

S.

Royal Botanical Gardens, Edinburgh, Scotland.
Botanic Gardens, Penang, Straits Settlements.
Botanic Gardens, Singapore, Straits Settlements.
Director, Gardens and Forests, Botanic Gardens, Singapore, Straits Settlements.

T.

Botanical Gardens, Hobart, Tasmania.

W.

Botanical Station, Grenada Island, British West Indies.
Botanical Station, Dominica, British West Indies.
Botanical Station, Antigua Island, West Indies.
Department of Agriculture for the West Indies, Bridgeton, Barbados, West Indies.
Botanic Experiment Station, Dodds Barbados, West Indies.
Botanic Gardens, Martinique, West Indies.
Botanic Station, St. Kitts, West Indies.
" " St. Lucia, West Indies.
" " St. Vincent, West Indies.
Botanic Gardens, Port of Spain, Trinidad, West Indies.
Botanical Department, Trinidad, West Indies.

THE WILD BIRD LAW.

ACT 104
SESSION LAWS OF 1907.

AN ACT

To Provide for the Protection of Birds Beneficial to the Forests of the Territory of Hawaii and to Define the Same.

Be it Enacted by the Legislature of the Territory of Hawaii:

Section 1.—For the purpose of this Act, Hawaiian geese (nene) and all perching birds (scientifically known as Passerine) that frequent the forests of this Territory shall be considered as beneficial, except such as are specified in Section 2.

Section 2. The European or house sparrow, the house finch, the rice bird, the mynah, the native crow or alala and any imported species of perching bird (or Passerine), (injurious to forestry or agriculture) shall not be protected by this Act.

Section 3. It shall be unlawful for any person to catch or kill any perching bird (or Passerine) other than those specified in Section 2, or to have in his or her possession the body of any such bird, or to take, destroy or have in possession the nest or eggs of any such bird.

Section 4. Any person violating this Act shall be guilty of a misdemeanor and on conviction shall be fined Ten Dollars ($10.00) for each offense, and Fifty Dollars ($50.00) for each perching bird (or Passerine) killed or caught, other than those specified in Section 2, or for each body or part of the body of such bird that he or she has in possession, or for each nest or egg of such bird as is destroyed or possessed in violation of this Act; or shall be liable to imprisonment for two weeks or to both fine and imprisonment at the discretion of the court; provided, however, that the preceding sections of this Act shall not apply to any person holding a permit, issued in accordance with the

provisions of the next Section of this Act, giving him or her the right to collect any species of perching bird (or Passerine), their eggs or nests for scientific purposes only, unless such person shall violate the conditions of such permit.

Section 5. To any person who shall furnish satisfactory evidence that he or she is a duly authorized agent of some scientific institution and is collecting birds, their nests or eggs, for such institution, or for private scientific study and not for sale, the Commissioners of Agriculture and Forestry of this Territory, or such agent as they appoint, may issue a permit to collect for such scientific purposes, a limited number of any species of perching birds (or Passerine), (the number of each and any species that may be caught or killed being stated by the aforesaid Commissioners of Agriculture and Forestry or the agent appointed by them), at any time between and including the first day of October and the last day of February next following, but at no other time whatsoever.

Section 6. Any person to whom such permit to collect perching birds (or Passerine), their eggs or nests shall be issued, shall file with the Commissioners of Agriculture and Forestry, or their agent, a good and sufficient bond to the Territory of Hawaii in the sum of Two Hundred Dollars ($200.00), with two responsible citizens of this Territory as sureties, conditioned that if the holder of said permit shall be convicted of violation of any of the provisions of this Act, or of those of the permit issued to him or her, the said bond shall be forfeited.

Section 7. The applicant to whom a permit to collect perching birds (or Passerine) is issued, shall pay a fee of One Dollar ($1.00) to defray the expense of such permit, said permit to bear the name and post office address of the holder, a copy of this Act, to which the holder shall attach his or her signature, and a list showing the greatest number of each species of perching bird that may be killed or caught by the holder of the permit; said permit is not transferable and holds good only for one season, i. e., from the first of October to the last day of February next following.

Section 8. In all proceedings against any person for violating the provisions of this Act, such person shall be deemed to be without the permit herein provided for unless he shall produce the same.

Section 9. All Acts and parts of Acts inconsistent with this Act are hereby repealed.

Section 10. This Act shall take effect from and after the date of its approval.

Approved this 25th day of April, A. D. 1907.

G. R. CARTER,
Governor of the Territory of Hawaii.

LIST OF THE DISTRICT FORESTERS.

(Corrected to June 30, 1908.)

Following is a list of the (thirty-nine) District Foresters with their respective jurisdictions. Those marked with a star (*) were appointed Special Territorial Police Officers to enforce the Terms of the Wild Bird Law, Act 104 of the Session Laws of 1907:

KAUAI.

* ALBERT S. WILCOX.

In and for the District of Halelea.

J. R. MYERS.

In and for the District of Koolau, excepting the land of Anahola.
[Appointed May 20, 1908.]

* GEORGE H. FAIRCHILD.

In and for the land of Anahola and the northern portion of the District of Puna, extending as far as the land of Wailua.

* F. WEBER.

In and for the portion of the District of Puna, south of and including the land of Wailua, except the lands controlled by Grove Farm Plantation.

* EDWARD BROADBENT.

In and for those lands in the District of Puna, controlled by the Grove Farm Plantation.

REV. J. M. LYDGATE and * WALTER D. McBRYDE.

In and for that portion of the District of Kona, lying to the east of the Hanapepe Valley.

* FRANCIS GAY.

In and for that portion of the District of Kona. lying between and including the Waimea, Poomau and Kauaikanana Valleys on the west and the Hanapepe Valley on the east.

* AUGUSTUS F. KNUDSEN.

In and for the District of Na Pali and that portion of the District of Kona, formerly known as the District of Waimea, lying to the west of the Waimea, Poomau and Kauaikanana Valleys.

OAHU.

* ANDREW ADAMS.

In and for the District of Koolauloa.

* L. L. McCANDLESS.

In and for that portion of the District of Koolaupoko extending from Koolauloa to the land of Heeia.

* W. C. WEEDON.

In and for that portion of the District of Koolaupoko extending from and including the land of Heeia to the land of Kailua.

* JOHN HERD.

In and for that portion of the District of Koolaupoko extending from and including the land of Kailua to Makapuu Point.

* PAUL R. ISENBERG.

In and for that portion of the District of Kona extending from Makapuu Point to and including Manoa Valley.

* WALTER F. DILLINGHAM.

In and for the Districts of Ewa and Waianae.

W. W. GOODALE.

In and for the District of Waialua.

MOLOKAI.

* JAMES MUNRO.

In and for the Island of Molokai, excepting that portion between the lands of Pukoo and Halawa, inclusive.

* C. C. CONRADT.

In and for the portion of the east end of the Island of Molokai, lying between the lands of Pukoo and Halawa.

LANAI.

* CHARLES GAY.

In and for the Island of Lanai.

MAUI.

H. P. BALDWIN.

District Forester at Large for the Island of Maui.

* L. BARKHAUSEN.

In and for the District of Lahaina.

* C. B. WELLS.

In and for the District of Wailuku.

* H. A. BALDWIN.

In and for the District of Hamakuapoko and the western half of the District of Hamakualoa.

* W. F. POGUE.

In and for the District of Koolau and the eastern half of the District of Hamakualoa.

* C. J. AUSTIN.

In and for the District of Hana.

* L. VON TEMPSKY.

In and for the District of Makawao.

L. VON TEMPSKY and DR. J. H. RAYMOND.

In and for the Districts of Kula, Honuaula, and the lands beyond to and including Kaupo.

HAWAII.

* G. C. WATT.

In and for the District of North Kohala, and that portion of the District of Hamakua lying between the District of North Kohala and the Waimanu Valley.

* A. W. CARTER.

In and for the District of South Kohala.

* A. AHRENS.

In and for that portion of the District of Hamakua from and including the Waimanu Valley to the District of Hilo.

* JOHN M. ROSS.

In and for that portion of the District of Hilo extending from the District of Hamakua to the land of Makahanaloa.

* JOHN A. SCOTT.

In and for that portion of the District of Hilo extending from the District of Puna to and including the land of Kikala.

* JOHN WATT.

In and for the District of Puna.

* JULIAN MONSARRAT.

In and for that portion of the District of Kau extending from the District of Puna to and including the land of Punaluu.

* GEORGE C. HEWITT.

In and for that portion of the District of Kau extending from the land of Punaluu to the District of Kona.

* R. VON S. DOMKOWITZ.

In and for that portion of the District of South Kona extending from the District of Kau to the land of Kaohe.

W. R. CASTLE.

In and for that portion of the District of South Kona extending from and including the land of Kaohe to the District of North Kona.

* JOHN D. PARIS.

In and for that portion of the District of North Kona extending from the District of South Kona to and including the land of Kahaluu.

* JOHN A. MAGUIRE.

In and for that portion of the District of North Kona extending from Kahaluu to the District of South Kohala.

LIST OF DISTRICT FIRE WARDENS.

(Corrected to June 30, 1908.)

Following is a list of (forty-nine) District Fire Wardens, with their respective Districts:

CHIEF FIRE WARDEN.

RALPH S. HOSMER,

Superintendent of Forestry, *ex officio*.

DEPUTY FIRE WARDEN AT LARGE.

DAVID HAUGHS.

In and for the Territory of Hawaii.

DISTRICT FIRE WARDENS.

KAUAI.

C. W. HUDSON.

In and for the Wainiha Valley, District of Halelea.

W. F. SANBORN.

In and for the District of Halelea, excepting the Wainiha Valley.

J. R. MYERS.

In and for the District of Koolau, excepting the land of Anahola.
[Appointed May 20, 1908.]

GEORGE H. FAIRCHILD.

In and for the portion of the Districts of Koolau and Puna, extending from the land of Anahola to the land of Olohena, inclusive.

F. WEBER.

In and for the portion of the District of Puna, south of and including the land of Wailua.

REV. J. M. LYDGATE.

In and for that portion of the District of Kona, formerly known as the District of Koloa.

FRANCIS GAY.

In and for that portion of the District of Kona, lying between and including the Waimea, Poomau and Kauaikanana Valleys on the west and the Hanapepe Valley on the east.

AUGUSTUS F. KNUDSEN.

In and for the District of Na Pali and that portion of the District of Kona, formerly known as the District of Waimea, lying to the west of the Waimea, Poomau and Kauaikanana Valleys.

OAHU.

ANDREW ADAMS.

In and for the District of Koolauloa.

FRANK PAHIA.

In and for that portion of the District of Koolaupoko, extending from the Koolauloa District line to the land of Heeia.

GEORGE CAMPBELL.

In and for that portion of the District of Koolaupoko, extending from and including the land of Heeia to the land of Kailua.

JOHN HERD.

In and for that portion of the District of Koolaupoko, extending from and including the land of Kailua to Makapuu Point.

CHARLES H. BAILEY.

In and for that portion of the District of Kona, extending from Makapuu Point to Palolo Valley.

H. J. RHODES.

In and for Palolo Valley, District of Kona.

W. M. GIFFARD.

In and for that portion of the District of Kona, lying between Puaoa and Manoa Valleys.

G. H. MOORE.

In and for Pauoa and Nuuanu Valleys, District of Kona.

WALTER F. DILLINGHAM.

In and for the District of Ewa and that portion of the District of Waianae lying to the East of the Waianae Mountains.

F. MEYER.

In and for that portion of the District of Waianae lying to the West of the Waianae Mountains.

* W. M. TEMPLETON.

In and for the District of Waialua.

MOLOKAI.

JAMES MUNRO.

In and for the Island of Molokai, excepting that portion between the lands of Pukoo and Halawa, inclusive.

C. C. CONRADT.

In and for that portion of the east end of the Island of Molokai, between the lands of Pukoo and Halawa, inclusive.

LANAI.

CHARLES GAY.

In and for the Island of Lanai.

MAUI.

H. P. BALDWIN.

Fire Warden at Large, for the Island of Maui.

LOUIS BARKHAUSEN.

In and for the District of Lahaina.

R. C. SEARLE.

In and for the District of Kaanapali.

C. B. WELLS.

In and for the District of Wailuku.

H. A. BALDWIN.

In and for the District of Hamakuapoko and the west half of the District of Hamakualoa.

W. F. POGUE.

In and for the District of Koolau and the east half of the District of Hamakualoa.

JOHN CHALMERS.

In and for the District of Hana.

.....

In and for the District of Kipahulu.

J. H. RAYMOND, M. D.

In and for the Districts of Honuaula and Kahikinui.

L. VON TEMPSKY.

In and for the Districts of Kula and Kaupo.

HAWAII.

G. C. WATT.

In and for that portion of the north half of the District of Kohala, extending from the land of Kaauhuhu to the Hamakua District line.

SAM P. WOODS.

In and for that portion of North Kohala, extending from the northern boundary of the land of Kawaihae I to and including the land of Kaauhuhu.

SAM M. SPENCER.

In and for the District of South Kohala.

AUGUST AHRENS.

In and for the western part of the District of Hamakua, extending to the boundary of the land of Paauhau.

JAMES GIBB.

In and for that portion of the District of Hamakua, extending from the western boundary of the land of Paauhau to the boundary of the land of Kukaiau.

ALBERT HORNER.

In and for that portion of the District of Hamakua, extending from and including the land of Kukaiau to the Hilo District line.

JOHN M. ROSS.

In and for that portion of the District of Hilo, extending from the Hamakua District line to the land of Makahanaloa.

JOHN T. MOIR.

In and for that portion of the District of Hilo, extending from and including the land of Makahanaloa to the land of Kikala.

JOHN A. SCOTT.

In and for that portion of the District of Hilo, extending from the Puna District line to and including the land of Kikala.

JOHN WATT.

In and for the District of Puna.

WILLIAM G. OGG.

In and for that portion of the District of Kau, extending from the Puna District line to and including the land of Punaluu.

CARL WALTERS.

In and for that portion of the District of Kau, extending from the land of Punaluu to the Kona District line.

R. VON S. DOMKOWITZ.

In and for that portion of the District of Kona, extending from the Kau District line to and including the land of Kaapuna.

T. C. WHITE. *Acting.*

In and for that portion of the District of Kona, extending from the land of Kaapuna to and including the land of Hookena.

JOHN D. PARIS.

In and for that portion of the District of Kona, extending from the land of Hookena to and including the land of Kaawaloa.

T. C. WHITE.

In and for that portion of the District of Kona, extending from the land of Kaawaloa to the land of Kahaluu.

JOHN A. MAGUIRE.

In and for that portion of the District of Kona, extending from the land of Kahaluu to the Kohala District line.

FOREST RANGER.

DAVID KAPIHE.

In and for that section of the District of Kona, Island of Oahu, bounded on the east by Manoa Valley, on the north by the Konahaunui Mountain Range, on the west by Pauoa Valley and on the south by the makai edge of the Eucalyptus forest, the Makiki reservoir and the mauka boundary of the Judd land in Makiki and Manoa.

Report of the Librarian.

Honolulu, Hawaii,
December 31, 1907.

Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen:—

In March 1904 the Commissioners of Agriculture and Forestry requested the Superintendent of Forestry to take charge of the library and of the routine work of the Board's office. I have the honor to submit my report on these matters for the past year.

LIBRARY.

The Library of the Board consists of books, pamphlets and magazines in relation to tropical and subtropical agriculture. The special features of the Library are carefully selected collections of books dealing with Botany, Entomology, Forestry and Animal Industry; a good assortment of periodicals covering current work in the same fields; and complete sets of all the publications issued in recent years by the United States Department of Agriculture, by the several State Experiment Stations and by the Smithsonian Institution and the National Museum.

As in the past the sections of the Library dealing with Entomology and Animal Industry have remained in the direct charge, respectively, of Mr. Jacob Kotinsky and Dr. V. A. Norgaard.

The following rough classification shows the number of books, bulletins, reports and other publications in the Library, exclusive of papers and magazines. Some sixty-odd journals, issued weekly, monthly and quarterly are regularly received.

Classification of Books

in the Library of the Board of Agriculture and Forestry.

Botany	407
Forestry	250
Entomology	
Books	421
Pamphlets	1273
Animal Industry	107
Agriculture and General Science	208
Hawaiiana	171
Reference Books	64
Smithsonian Institution and United States National Museum	194
United States Department of Agriculture	1143
State Experiment Station publications	3250
Philippine publications	56
Other Government Reports	212
Miscellaneous	496
Total	8252

The Library is open to the public for reference. Visitors are always made welcome. And as far as may be, the members of the Board staff are ready to give what additional assistance may be required. Every favorable opportunity has been taken to direct the attention of the public to the Library. During 1907 the number of persons making use of it has somewhat increased —the most encouraging gain being in the way of pupils from the Normal School.

USE OF THE BOARD BUILDING.

Meetings.

The Library room of the Board building continues to be used for the meetings of the Commissioners, for forest reserve hear-

ings, and for various gatherings having more or less closely to do with agriculture. In 1907 there were held in all twenty-six evening meetings, by the following organizations:

Hawaiian Entomological Society	6
Hawaiian Poultry Association	15
Honolulu Improvement Advisory Board	4
Waialae, Palolo and Kaimuki Improvement Club	1
Total	26

Exhibit Room.

The exhibit room with its specimens of island-grown fruits, native woods and other objects of interest continues to attract the attention of visitors. The collection of fruits is of value as showing what can be done in local gardens. These specimens demonstrate that many subtropical fruits can be grown successfully in this Territory. At present they are only found on the tables of a few individuals. Cultivated and grown with care and intelligence there is no good reason why they should not be a feature of our local markets and in time an important item in our export trade.

Visitors.

The number of visitors who registered during the year is 357. This figure is however probably not more than one half of those who called at the office of the Board on one or another errand. Persons coming to consult the members of the staff seldom sign the register and of those who are primarily sight-seers, many neglect to do so.

CLERICAL AND ROUTINE WORK.

To secure tangible results much of the work carried on by the Board of Agriculture and Forestry must have the continued backing of a strong, intelligent public sentiment. If the true

aims and objects of the work are understood there is no question of securing cordial support. In order that knowledge of what the Board is doing and intends to do may be wide-spread, many reports are prepared and a large number of letters annually written. Especially is this true of the Division of Forestry, where a special effort has been made to set forth the reasons that make certain work necessary.

The Clerk of the Board is also the Stenographer of the Division of Forestry. It appears from the office records that during the year 1907, letters and reports were prepared as follows:

Reports.

Forest Committee	8
Superintendent of Forestry:	
Forest Reserves	7
Miscellaneous	7
Routine	6
Forest Nurseryman:	
Planting Plans	8
Routine	12
Total	48

Letters.

Board	20
Superintendent of Forestry	475
Chief Fire Warden	26
Librarian	36
Forest Nurseryman	372
Total	929

Distribution of Yearbooks and free seed.

In continuation of the usage of former years there were distributed through this office, during 1907, the quota of free Con-

gressional vegetable seed and of the Yearbook of the United States Department of Agriculture for 1906 assigned to the Territorial Delegate to Congress, the Honorable J. K. Kalanianaole. Special efforts were made to place both the seed and the Yearbooks where they would do the most good. In each case the public schools, particularly those having school gardens, received first attention. But enough seed and Yearbooks were received to meet the requests of all who applied.

Personnel.

Miss Melika Peterson, the Clerk of the Board, was granted leave of absence for six months on December 21, 1907, to permit her to go to the Coast for treatment for a persistent eye trouble. During her absence her place is taken by Miss Katherine Hannestad, who had for some weeks prior to Miss Peterson's departure been engaged in clerical work at the office of the Board.

Forester and Agriculturist.

While technically distinct from the routine duties of the Board, the publication of the Hawaiian Forester and Agriculturist is so closely connected with the work of the several divisions that mention of it may properly be made here.

The Hawaiian Forester and Agriculturist is a monthly journal, issued by the Hawaiian Gazette Company of Honolulu, under the direction of the Board of Agriculture and Forestry. It is devoted to Forestry, Entomology and Agriculture—especially to the development in Hawaii of diversified agricultural industries. The editor is Mr. Leopold G. Blackman. The volume for 1907 (Volume IV), contains 372 pages and a considerable number of full page and text illustrations. The subscription price is one dollar a year.

BUILDINGS AND GROUNDS.

During the past six months a very marked and much needed improvement has taken place at the Government Nursery

through the filling in of the low lying portions of the grounds and the grading and curbing of the walks. This bringing of the surface up to grade will relieve the Nursery of the excess water that in times of heavy rains formerly collected at the west end of the grounds. The filling was done through the cooperation with the Board of the former and of the present Superintendent of Public Works—Mr. C. S. Holloway and Mr. Marston Campbell. The greater part of the cost was paid from the Public Works Department appropriation for the care and maintenance of Public Buildings and grounds.

In the spring of 1907 the cottage in the Nursery grounds that for some months had remained unoccupied, was put into repair to be used by the Forest Nurseryman. Mr. Haughs moved in on April 23, 1907.

Under a special appropriation made by the Legislature in the spring of 1907, a laboratory building for the Division of Animal Industry was erected during the summer on the Ewa side of the main office building. The building was ready for occupancy in September. It will prove of great value in the work of that Division.

Besides improvements in the seed testing house, several minor changes have been made in connection with the stables and potting sheds that increase the value of the Plant by providing better and more convenient means of doing the necessary work.

When the work of improving the condition of the grounds is finally completed, the Government Nursery as a whole will be a more useful as well as a more attractive piece of Government property than at any time in its history.

Very respectfully,

RALPH S. HOSMER,

Librarian.

DIVISION OF ENTOMOLOGY.

Report of the Superintendent of Entomology and Inspector

Honolulu, December 31, 1907.

To the

Honorable Board of Commissioners of
Agriculture and Forestry,
Honolulu, T. H.

GENTLEMEN:—I have the honor to submit the following Report covering the work of the Division of Entomology for the year ending December 31st, 1907.

INSPECTION OF IMPORTATIONS.

During the period above named we have boarded 306 steam and sailing vessels arriving at this port from outside the Territory, from which were discharged and inspected 101,923 packages of fruits and vegetables. Of these we destroyed or returned to the shippers 690 packages infested with injurious insects or plant diseases. In addition to the above consignments there were inspected 228 packages of plants and seeds received through the mails. Many of these were fumigated in the usual manner because of insect pests found on same.

IMPORTATIONS OF JAPANESE RICE.

In my last Annual Report I made particular mention of the large importations of this article arriving at Honolulu from Japan, the bulk of which being infested with injurious insects had to be fumigated at the cost of much time to the employees of the Department and at much expense to the consignees. In order to comply with the regulations of

the Board the Japanese Government has since that period issued regulations to have all such rice treated with carbon-bisulphide before shipment, and has ordered that the containers shall bear the stamp of the Government's Agent showing that the contents had been fumigated. Upon inspection of such of the rice as came in this manner it was found that the method adopted by the Japanese authorities worked very satisfactorily. Unfortunately the Government Agent at point of shipment ran out of chemicals during a portion of the season, and your Department was in consequence obliged to treat 21,926 sacks of the rice landed here. The method of fumigation adopted was the same as that reported by me in a previous report, and the cost attending same, as is usual in such cases, was borne by the consignees.

INSECTS AND OTHER PESTS FOUND UPON IMPORTATIONS.

POTATO PESTS. Upon examination of 400 crates of Potatoes which arrived here from Sydney during April last, all these were found to be seriously infested with the larvae of the "Potato Moth" (Lita solanella). Arrangements were therefore made with the steamer officials to have these dumped at sea, the Department having refusd to allow them entry at this port. The accompanying illustrations (Pl. I.) will give some idea of the destructiveness of this pest, and I might add that not a single tuber of the large proportion inspected could be found without one or more of the larvae in the same; in fact, some were so badly attacked that not an inch of healthy tuber could be found. The larvae of these moths appear to select the depressions about the eye of the potato in which to spin their cocoons.

In August last a shipment of 220 sacks of Potatoes arrived from San Francisco badly affected with "Potato Scab," and these were in consequence returned to the shipper.

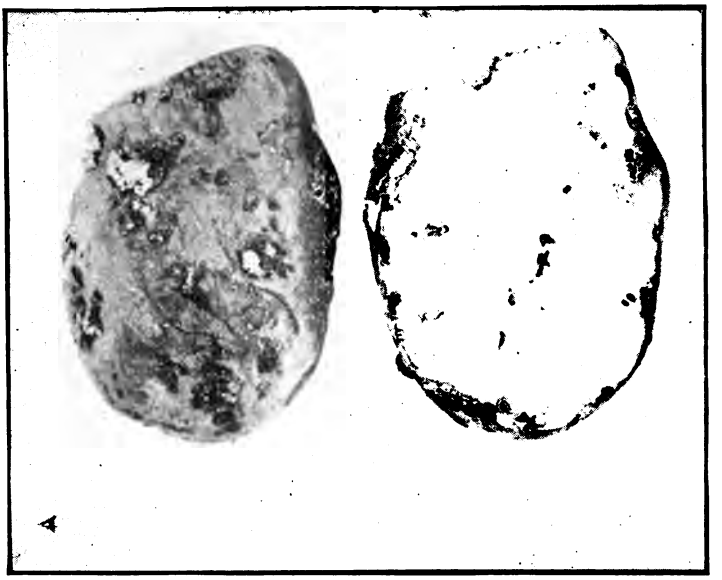


FIG. 1.—Surface and Section of Potato Showing Injury by Potato Moth [*Lita Solanella*].

FIG. 2.—The Worms or Larvæ of Potato Moth [*L. Solanella*].

INFESTED GARLIC. Importations of this article at this port have heretofore been found free from insects. One consignment, however, which was temporarily landed here from Australia by mistake, was found to be attacked by a small brown beetle. The packages were intended for San Francisco, and having been returned on board the steamer which brought them, the Plant Quarantine Inspector of that port was duly notified of their condition.

APPLE PESTS. Seventy boxes of Apples arriving from San Francisco in April last were found to be infested with "San Jose Scale". This fruit was returned immediately to the above port.

DISEASED SUGAR CANE. Consignments of seed and other sugar canes from foreign and mainland ports have apparently not been so frequent during the past period, one shipment only having come to my notice. This consisted of a package of seed cane from the Orient addressed to parties on the Island of Hawaii. An examination of same showed no signs of insect life, but as there were evidences of fungus disease the Plant Pathologist of the Planters' Experiment Station was called in consultation, and he declared the cane to be infested with a fungus which appeared to be different from any known species in the Territory. Arrangements were therefore made to destroy the consignment without unnecessary delay. In connection with importations of Sugar Cane I respectfully submit that the regulations of the Board should, if possible, provide against the introduction into this Territory of all sugar cane, regardless of point of origin. Past and present experiences show that there are individuals who insist (innocently perhaps) upon taking advantage of opportunities to introduce so called "new varieties". In view of the immense losses sustained in the past by our Island plantations because of introduced insect and other pests affecting sugar cane, and further, because of the well known fact that there are yet many pests in other cane growing

countries which could well adapt themselves to our tropical conditions here, and which might yet possibly be introduced, the introduction of cane into the Territory should be made a misdemeanor. The fact that the Planters' Experiment Station has for two years past succeeded in raising its own Cane Seedlings makes it entirely unnecessary for the Territory to take any risk in allowing importations from foreign or other cane growing countries. Whilst your Department is ever vigilant in watching for such consignments, yet, there have been occasions when these have come by mail or otherwise, without any indication on the packages as to the contents thereof. Two instances of this kind were accidentally discovered some time ago, and it is impossible to say how many others have since passed through without inspection because of a failure of the shippers to state contents of the package. Were it not for the courtesy of the U. S. Customs and Postal Officials at this port, and the fact that they use every effort to cooperate with this Department, many such consignments might be introduced without the knowledge of your Inspector.

GRAPE VINE CUTTINGS, &c. As usual all such vines have been treated with carbon bisulphide in order to guard against the introduction of Phylloxera.

INFESTED LUPIN SEED. Last December a consignment of 360 sacks of lupin seed arrived here from Italy via Australia. Upon inspection it was found that a portion of the seed was infested with a coleopterous larva because of which the entire shipment was thoroughly fumigated.

RUBBER SEED. A large shipment of this seed consisting of 110 packages was introduced here in December last from Ceylon via China. These being affected with "mites" the consignment was treated with carbon-bisulphide, resulting in the death of the latter without affecting the seed which I was later informed had germinated freely.

FOREIGN FRUITS.

In order to minimize the introduction of "Fruit Flies", all fruits emanating from Polynesia, Asia, and Australasia, as well as other places where these pests are known to exist, have been destroyed in accordance with the regulations of the Board. Only small consignments of these were received, however.

LOCAL INSPECTION WORK.

MANGO SCALE.

Continued inspection of Indian Mango trees introduced some time back, and which were thoroughly fumigated last year, has resulted in a failure to find any evidences of a recurrence of the "Mango Scale" (Coccus mangiferae). It is hoped that parties who have either purchased or secured any such trees from importers or others will notify the Department of such fact in order that their trees may be inspected and if necessary fumigated.

FUMIGATION OF PLANTS EXPORTED.

Your Department has had frequent applications during the past period from parties wishing to fumigate plants and trees which they intended to send abroad. Whilst such action on the part of the Department is not required by our laws and regulations, it is, nevertheless, commendable that there are some who desire to use every means in their power to prevent the spread of noxious pests to other countries.

GENERAL WORK.

The Inspector as well as the Assistants in the Department have continued, as heretofore, the regular local inspection and other work arising from the numerous demands made by the public in connection with insect pests in their gardens and fruit orchards. In many such cases colonies of certain beneficial insects have been liberated and these have assisted in controlling some of the pests complained of, whilst in others the trees and plants have been either sprayed or fumigated.

Appended hereto I beg to submit the Report of the Assistant Entomologist of this Department who has had in charge the

BREEDING and DISTRIBUTION of BENEFICIAL INSECTS, including such as have been sent here during the past year by Prof. Koebele

Respectfully submitted,

ALEXANDER CRAW,

Superintendent and Inspector of the
Division of Entomology,
Territorial Board of Agriculture & Forestry.

(Appendix to Annual Report of Superintendent and Inspector.)

INTRODUCTION, BREEDING AND DISTRIBUTION OF BENEFICIAL INSECTS.

Honolulu, T. H., December 31, 1907.

Alexander Craw, Esq.,
Superintendent and Inspector,
Division of Entomology,
Board of Commissioners of
Agriculture and Forestry,
Honolulu, T. H.

Dear Sir:—Herewith is the report bearing upon the Division's work of introduction, breeding and distribution of beneficial insects during the past calendar year.

Respectfully submitted,
JACOB KOTINSKY,
Assistant Entomologist.

BENEFICIAL INSECT IMPORTATIONS.

The introductions during the year were few, but the breeding and distribution of beneficial insects, especially dung-fly parasites, were carried on extensively.

CALIFORNIA APHIS PARASITE.

In April we received a large colony of parasitised orange aphis from California, kindly collected and sent by Mr. E. M. Ehrhorn, California's First Deputy Commissioner of Horticulture. Large numbers of the parasite (Trioxys?) were bred from this material. It so happened that aphis were scarce in Honolulu just then, and only after long search was an aphis-infested tree finally found in Wahiawa and a large colony of the parasite liberated upon it. In no instance was the parasite observed to attack an aphis and, as it has not been observed since, the inference is that it may possibly not attack our species which, according to Mr. Kirkaldy, is distinct from the California orange aphid.

LADYBIRDS FROM MEXICO.

Early in May a large colony of *Hyperaspis 8-notata* was received from Mr. Koebele in excellent condition. The ladybirds were collected in Mexico and intended to feed on our Avocado mealy bug (*Pseudococcus nipae*) upon which it was released in large numbers. Mr. Koebele wrote at the time that in Mexico the ladybird was feeding on eggs of cottony scales. Here too it was observed eagerly searching for food under cottony sacks, and an effort was made to locate a colony of *Pulvinaria psidii*, but none could be found at the time.

BENEFICIAL INSECT DISTRIBUTIONS.

ARIZONA DUNG-FLY PARASITE.

BREEDING.—This parasite was very much in demand, to satisfy which special breeding cages were constructed and a concentrated effort made to breed large numbers for extensive distribution. A dozen cages were built following the general plan of those Mr. Craw devised and used in California (1st. Biennial Report Com. Hort. Calif., 1903-4, pl. VIII), ours being merely modified to suit the material handled.

DISTRIBUTION.—In all 100 large colonies of the parasite were sent out during the year. Stock breeders on all the islands so far as their names could be secured were supplied. As with certain other beneficial insects we are now so situated that we can supply colonies upon a month's notice.

ESTABLISHMENT.—At the April (1907) meeting of the Hawaiian Entomological Society a member reported having captured a specimen of this parasite in Makiki. On the day of the meeting (April 4) your assistants visited a dairy ranch in Palolo Valley and there discovered the parasites in sufficient numbers to warrant their belief that the insect was definitely established there. Moreover, the comparatively small number upon the cattle of the flies that usually worry them gave a clue to the probable effective work of the parasite. All the material for purposes of breeding and distribution has been collected on that ranch and many thousands of the parasite bred and released.

Even more interesting than the collection of the Makiki specimen is your assistant's (Mr. G. A. Jordan) observation of the parasite many miles from the nearest place where a colony was released in the vicinity of Pearl City. This indicates the wide, unaided distribution of the parasite. It is evidently also gaining foothold on the other islands as it has been bred from pupae collected on Kauai by our Honorary Inspector, Mr. W. D. McBryde.

EFFECT ON HORN FLY.—It is doubtful whether the insect is a specific parasite on horn fly all evidence thus far being against such a supposition. In the field it is usually found ovipositing in droppings 3—4 days old—at a period when the larger maggot, i. e. those evidently of the stable fly (*Stomoxys calcitrans*) have attained their maximum both numerically and in size. Horn fly larvae (*Haematobia serrata*) were usually found full grown in largest numbers in cow droppings 5 or more days old. Yet the parasite has been bred from horn-fly larvae and in course of breeding the insect for distribution, it was not unusual to see specimens of the parasites evidently issued from horn-fly pupae. The mere presence of the insect in a pasture in large numbers is indicative of good work, yet it still remains to be seen to what a degree its work will affect our horn-fly problem, and how soon. Thus the statement in the Third Report of the Board (for 1906, p. 148) is verified by later observations and experience. To quote: "It is now beyond doubt that the parasite does and will attack the horn-fly larva and pupa, tho it will probably show preference for the larger hosts inhabiting the same medium. But even in the latter event it can not but prove useful, both directly and indirectly. Directly, by reducing the numbers of the larger flies that inhabit cattle droppings. Indirectly by reducing the number of the larger maggots and pupae as a source of food to the mynah bird and other predators and thus compelling them to feed on the smaller fly, including horn-fly larvae and pupae." We are now nearer the solution of the problem involved by the certainty that the parasite is definitely established on the islands.

COLONIES OF BENEFICIAL INSECTS DISTRIBUTED DURING 1907.

NAME	Hawaii	Maui	Molokai	Oahu	Kauai	Lanai	California	New Caledonia
HORN FLY ENEMIES								
Arizona-dung-fly parasite (*Eucoila impatiens*)	26	18	5	36	12	1		
SCALE BUG AND APHIS ENEMIES								
8-spotted ladybird (*Coccinella repanda*)		3						
10-spotted ladybird (*Coelophora pupillate*)		2						
"Brownie" ladybird (*Cryptolaemus montrouzieri*)				5				
Hyperaspis 8-notata				2				
"Vedalia" ladybird (*Novius cardinalis*)	1							
"Steel-blue" ladybird (*Orcus chalybeus*)		2						
"Yellow-shouldered" ladybird (*Platyomus lividigaster*)		3						
"Black" ladybird (*Rhizobius ventralis*)	1	2			2			
Scymnus notescens		1						
Trioxys testaceipes (?)				1				
MISCELLANEOUS								
Siphanta egg parasite (*Aphanomerus pusillus*)	6			1				
Coccinellidae (Misc.)	1						1	
Jap. beetle fungus				7	1			
Lantana insects								*1

* This colony was given the French Consul at his request, who sent it on his own responsibility by the "Catinat", but never reached there owing to the long cruise.

SIPHANTA OR TORPEDO BUG PARASITE.

As stated in your last report, the convenient sources of supply for distribution of this useful parasite (*Aphanomerus pusillus* Perk.) on this island were exhausted. Both host and parasite are at a constant minimum. To supply this year's demand for the insect we were dependent upon Brother Matthias of Hilo who had fortunately established it in that vicinity. All went well until toward the end of the year when he too was confronted by a scarcity of both host and parasite. Verbal reports of the practical disappearance of the pest have also been received from coffee growers in the Hamakua and Kona districts of Hawaii, and the other side of this island. The breeding and distribution of this parasite began in 1905 shortly after its introduction here from Australia where it was collected by Messrs. Koebele and Perkins.

INSECT INVESTIGATIONS IN MEXICO

By Albert Koebele,
Consulting Entomologist.

INTRODUCTION.

On my former visits to Mexico, I have never had an opportunity of making a systematic study of the insects affecting sugar-cane in that country, so during my recent stay there, I thought it advisable to investigate these. Even now, what we have learned can only be considered as a preliminary study. If we were to consider the numerous beetles, found on and in connection with the sugar-cane, the flies, the moths, the grass hoppers, which at times become very numerous, and finally the great number of species of leaf hoppers, the list would run up into the thousands.

In a casual inspection of the cane-fields one would hardly suspect any serious enemy to be present. Those engaged in cane culture have often remarked to me: "We have no insects on sugar-cane". Yet the mothborer (*Diatraea saccharalis*) is not only distributed over Mexico, but in many other localities and either it or an allied species is nearly of world-wide distri-

bution in cane-growing countries. Should these insects ever turn up in the Hawaiian Islands, and continue their work undisturbed by any natural enemies, I should not hesitate in saying that fifty per cent of the plants would be destroyed.

As we know that fully half the eggs laid by this moth are destroyed by parasites in Mexico, while probably many of the caterpillars are also destroyed by other parasites and various other enemies, the danger is but slight. The conditions that exist in Mexico could be established here, in fact a large improvement could be made on these conditions, and this in a short time after the moth's first appearance. That this moth-borer will one day be found in the islands is not at all improbable in my opinion. Though it has been already credited as a member of our Fauna by Dyar and others, no specimen, so far, has ever been found in the islands, and these entomologists are, happily, in error on this point.

The large Jassid leaf-hopper, which I call the Mexican sugar-cane hopper, is a comparatively rare insect in its native home. Probably it is found much further south and also in the West Indies. Unquestionably it would become a great pest if accidentally brought into the islands without its parasites. Now that we are familiar with its many enemies, it is no longer to be feared, for its parasites with proper treatment would easily stand the short journey to the islands, or a much longer one for that matter. Below I have given an account of the more important insects found on sugar-cane in Mexico. None of these are at present known in our cane-fields; and should they be found, my investigations would enable us to prevent a reoccurrence of the loss experienced after the introduction of our leaf-hopper.

THE MOTH-BORER OF THE SUGAR-CANE.

This is certainly the most injurious insect to the sugar-cane in Mexico. It was noted some eighty years ago as a great pest on this plant in the West Indies, and since then it has been reported from various other localities, while in others including

the East Indies a very similar species is likewise injurious. In the United States it is known as a pest on sugar-cane, sorghum, and corn, while it is likewise known to attack the "Gama grass" (*Tripascum dactyloides*).

In "Insect Life" (Vol. IV. pp. 95-103) Dr. Howard has given an exhaustive account of its life-history, distribution, the depredation caused by its caterpillar, and references to various publications on the insect, but in the articles that I have seen there is no mention of its parasites. More recently, however, the presence of egg-parasites has been noted in the West Indies. These parasites have been referred to a well-known and widely distributed species the *Trichogramma pretiosa* of Riley.

In March I visited some cane-fields near Hermosillo in Sonora. At that time it was very dry and no sugar-cane was growing in these fields. The land had just been ploughed and the stools were lying about, more or less dried up. In these numerous larvae could be found, in fact, some of the stools were so badly mined and eaten out by them that few healthy plants could have been produced. The seed cane had been laid on the ground to a depth of some three feet, and covered by several feet of old cane leaves. Here the larvae were more numerous than in the old stools.

On every opportunity I examined the white variety of cane, sold for eating, at Nogales; and at Hermosillo a large quantity of a striped variety was shown me in an out-house. In none of these could I detect any eggs of leaf-hoppers, the moth-borer being the only insect found therein.

As a remedy in Mexico ploughing up and burning the stools is performed annually. Flooding the fields after cutting, as is done in Morelos and Vera Cruz also destroys many larvae. I had ample proof of this in my observations in a very wet field near Orizaba.

On my first visit to a cane-field in the State of Morelos I was able to note other interesting facts. Here I found a fresh batch of eggs of the moth-borer, and on the top of this a black Chalcid

parasite was resting and laying its eggs in those of the moth. This parasite and the batch of eggs were placed in a glass vial, and during the following day it was again noticed ovipositing in the moth's eggs, but was dead on the morning of the third day. The vial and its contents were taken to Mexico City, where the temperature was rather low, and later to California, where after fifty days nine parasites emerged. Most of the other eggs had produced young larvae some time previously. This parasite does splendid work, fully fifty per cent—if not more—of the eggs of the moth-borer are destroyed by it. It is equally numerous in the State of Vera Cruz, where a second and much smaller parasite was bred, two or three issuing from a single egg of the moth.

A mature caterpillar, collected in the State of Vera Cruz, kept in a box, where it had spun up in the top of a piece of cane, produced the larva of a parasite fly (*Tachina*). This larva pupated, but the mature insect was not bred.

NOCTUID LARVAE IN CANE-TOPS.

At all the places visited, the caterpillar of a Noctuid moth, probably an *Agrotis* was found on the cane. When young the caterpillars often occur in numbers together, but when large or full-grown generally singly, feeding upon the tender leaves of the cane-tops. During the time of my visit no serious injury was done by these, but if numerous their work would be very harmful. I did not breed the moth of these caterpillars.

The small eggs are laid in clusters anywhere on the upper leaves, and from these eggs a very minute Chalcid parasite was bred. On a nearly full-grown caterpillar I found the egg of another parasite. No doubt this species will be found to have a large number of parasitic as well as predaceous enemies.

Of other caterpillars found feeding on cane, a few may be mentioned here. In a small space, the work of a large green Bombycid larva a species of *Automeris* was apparent, a colony of this species having, no doubt, been present. These caterpil-

lars are omnivorous and may be found on many plants and trees.

A small mouse-colored, hairy caterpillar, bearing four prominent white tufts, and belonging to the genus *Halisidota* was present, but of no importance as a sugar-cane pest.

Not far from an alligator pear tree, on which the larvae may have fed, and then wandered off to pupate, cocoons of a small Bombycid moth were found in the cane, but only in one locality. From these cocoons a large Chalcid parasite emerged. Eggs of a small Bombycid moth, producing small, pale, slender and hairy larvae, were also observed.

An egg-mass, not unlike that of the moth-borer, but containing many more eggs of far smaller size, was found on the under side of a cane-leaf in the State of Morelos. This may have belonged to a Tortricid moth, the larvae of which were observed in the same field of young cane.

LEAF-HOPPERS.

The Large Mexican Sugar-cane Leaf-hopper. This is a large Jassid leaf-hopper, about three-quarters of an inch in length, the scientific name of which is *Cyrtodisca major*. Prof. Herrera informed me that the insect had been received from Jonacatepec, Morelos, where it is a plague to sugar-cane in the State and presented me with specimens. Having traveled over a large part of the same State, and to within about seventeen miles of Jonacatepec, it is singular that I did not meet with a single specimen of this gigantic leaf-hopper there, nor yet again in Vera Cruz. The insect has been described in an American paper as a new pest on sugar-cane in Mexico, but I anticipate no serious trouble from this insect, as an enemy of cane. While working on the Lantana insects in 1902, colonies of leaf-hoppers were met with living on that plant gregariously and these belong partly to the above named species and partly to others of the genus. Prof. Herrera showed me examples of a related species that lives on the twigs of orange trees.

The Mexican Sugar-cane Hopper. This *Cyrtodisca* is not unlike the preceding, but has the head more pointed and is only about half an inch in length. It is of a dull blackish color, more handsomely marked in the State of Vera Cruz, having a light yellow dorsal line on the head and orange on the pronotum. It is equally distributed in all the places I visited, breeding throughout the year. Yet owing to the very efficient parasites that attack it, destroying a large percentage of its eggs, it is not very numerous. I have not seen more than eight or ten mature insects in one cane-top, which is the part they mostly affect. The eggs that presumably belong to this insect (for I had no opportunity to rear it) are laid in the midribs of the leaf, usually near the base, yet sometimes far forwards, rarely in the leaf-sheath. I did not observe that they were ever laid in the cane stem. A crescentic slit is made either on the lower or upper surface and the eggs are placed together beneath the epidermis, nearly always on the top of the midrib. The young nymph on hatching is pale, probably after the first moult it becomes dark brown, except for the pale abdomen. The larger nymphs are again pale yellow with transverse narrow black bands across the wing pads, while the legs are also black.

Many nymphal skins are found on the under side of the older leaves, but as the nymphs become larger they seek the more tender leaves of the top. The mature insects are very active, the slightest jar on the plants will rouse them from their hiding place, ready for their jump. They usually fly off for some distance and settle again on another plant or even on the ground. Prof. Herrera was not acquainted with this insect.

As is the case in Australia and Fiji with our cane leaf-hopper, the eggs of the Mexican hopper are largely destroyed by fungous diseases. At least two species of Mymarid parasites were bred from its eggs and appear to be very numerous, as also are several species of minute Chalcid parasites. The parasites bred from collected eggs were much more numerous than the young hoppers. As the season was late, these conditions may be different

about midsummer. These parasites could easily be transferred, for during the cool winter months the Mymarids issued from eggs six weeks after these had been collected. A small yellow Chalcid issued from eggs collected on Dec. 14, 1907 up to Feb. 16, 1908, when the material was kept in a room with a temperature of about fifty degrees at night and seventy at midday. These minute insects lived for eight or ten days, when supplied with water, which they drink eagerly. For their preservation alive, it is obviously necessary to keep the material in a proper state of moisture.

No trace of Dryinid parasites could be detected on this insect, yet it is just possible that such may be found at another season. Parasitic flies of the genus *Pipunculus* were noticed in the cane-fields, but none were bred.

Possibly a valuable agent in reducing the numbers of this and other leaf-hoppers on sugar-cane, as well as the Noctuid caterpillars that I have already referred to, is a medium-sized Reduviid bug. It lives in the tops of the cane plants and its nymphs are probably more valuable than the adults, as they wander less. An egg mass of this species produced young, that lived in a glass tube, without food, for a long time; one, indeed, survived for four weeks, having probably sustained itself by devouring its companions.

An ear-wig (*Sphingolabis taeniata*) is also found commonly in the cane tops, and no doubt feeds both on the leaf-hoppers and the Noctuid caterpillars.

Several other species of Jassid leaf-hoppers were found living on sugar-cane. In fields containing weeds and grass they were especially numerous, being most abundant along the borders of the field and in places covered with "Para" grass. This grass is alive with masses of leaf-hoppers, both Fulgorid and Jassid. In the center of clean fields and away from grass these leaf-hoppers, excepting the one I have specially termed the Mexican cane-hopper, become very rare, yet the fact that they breed on

sugar-cane is evident, since their nymphs were found on this plant in the months of November and December.

The Chinch Bug (*Blissus leucopterus* Say) is also found on cane, both in Morelos and Vera Cruz, and I also collected it in the City of Mexico.

Fulgorid Leaf-hoppers. A large number of species of leaf-hoppers related to our cane leaf-hopper could certainly be found in Mexico on sugar-cane, in fact I have secured quite a number of different forms. Yet, only in the State of Morelos did I find three egg-masses, which, I believe, belong to a Fulgorid. They were irregularly inserted in and near the midrib, one batch on the under side and the others on top of the leaves. Some of these eggs were covered over with a white excretion as usual, but others were entirely exposed, giving easy access to parasites. From these eggs collected November 27th, four Mymarid parasites issued on December the 10th.

OTHER INSECTS ON CANE.

One species of a Tingid bug was found breeding on the under side of cane leaves in the State of Vera Cruz, and it was evident that in one part of the field a number of colonies had been present, but at the time I found them few specimens remained.

Aphidae or Plant-lice appear to be common during the season on the cane, but during my visit were rarely met with. In spite of this their natural enemies were still in large numbers, both Syrphidae, Chrysopidae and Coccinellidae. Of the lady bugs *Megilla maculata* Say was most numerous in Morelos, *M. vittigera* Mann. was found near Orizaba, *Hippodamia convergens* Guer. numerous everywhere, as also was *Coccinella sanguinea* Linn. Two species of *Scymnus* were also present, and were probably feeding on plant-lice.

A species of fly of small size was found, the larva of which burrows in the midribs of the cane leaves. The mine made by this slender larva often extends throughout the whole length of the leaf, in other cases it extends ten or twelve inches, the larva

having turned round and formed two or three mines side by side. When full-grown, it eats out a hole almost to the surface of the midrib, and pupates there. Finally the puparium is pushed through the thin covering above it and the fly issues therefrom. Although common, I did not breed many of this fly and no parasites were observed, though, I doubt not, such are present.

Another fly breeds commonly in the decaying parts of the sugar-cane, where these have been attacked by the caterpillar of the moth-borer. It is very numerous, yet cannot be said of itself to do any real injury to the cane.

EXTERIOR OF NEW RESEARCH LABRATORY.

DIVISION OF ANIMAL INDUSTRY

Report for the Year Ending Dec. 31, 1907

By Victor A. Norgaard, V. S. (Copenhagen).

Superintendent of Animal Industry, Board of Agriculture and Forestry, Territory of Hawaii.

Veterinary Inspector U. S. Bureau of Animal Industry.

LETTER OF SUBMITTAL.

The Board of Commissioners of Agriculture and Forestry,
Honolulu, Territory of Hawaii.

Gentlemen:—

I beg to submit herewith my third annual report as Territorial Veterinarian covering the work of the Division of Animal Industry for the year of 1907.

The most important work of the Division has, as in the preceding years, been the inspection service, established for the purpose of preventing the introduction of diseased live stock to the Territory. The past year marks, however, a complete change in this branch of the work in so far that it has been made compulsory for horse stock and cattle to be tested for glanders and tuberculosis before shipment to the Territory, while formerly it was optional with the owners or importers to have the testing done either before shipment or after arrival here.

This most important and highly desirable change was only made possible through the concession of the Federal Department of Agriculture in allowing your Honorable Board to promulgate regulations demanding a certificate of inspection and test issued by an officer of the Federal Bureau of Animal Industry as contingent upon the admission of such live stock to the Territory.

This concession, which I have endeavored to bring about for more than three years, was finally granted as a result of the repeated arrival in the Territory of horse stock affected with glanders,—notwithstanding our efforts to protect the live stock of the Territory by every means the laws of Hawaii would permit of.

The new system of inspection, which only went into effect with the expiration of 1907, required a complete revision of the rules and regulations governing the importation of live stock, and was made to include sheep and swine, which in the future will require the certificate of a federal inspector to the effect that they are free from infective diseases and have not been exposed to them.

Of equal importance to the inspection service is the work of the Division in investigating outbreaks of infectious and contagious diseases among live stock in the Territory and the measures taken for the suppression and eradication of the same. Glanders among horse stock, tuberculosis and actinomycosis among cattle and parasitic diseases among sheep, have, as hitherto, occupied the principal attention of the Division, and are fully discussed in this report. The same is the case with a rather unusual outbreak of mouth disease in horses on Maui, and a very wide-spread epizooty of laryngitis among horses, which spread to practically all of the Islands. Lead poisoning in cattle, causing a considerable number of deaths among valuable breeding stock, is fully described in order that a repetition thereof may be avoided in the future.

A new pathological laboratory, for which provision was made by the Legislature of 1907, has been built and equipped and, it is confidently expected, will assist materially in the solution of various perplexing problems such as hematuria (red water) in cattle and osteoporosis (big head) among horses. The laboratory is fully equipped with modern scientific apparatus for the diagnosing of infectious and contagious diseases and for the determination of pathological specimens forwarded for investigation.

The efforts of the writer to have mule-breeding given a thorough trial here has been rewarded by the importation of not less than eight high-class jacks. If the suggestion contained in my previous reports, to provide the mares and colts with an abundance of bone-building material is followed, there is every reason to believe that the not too distant future will see the Territory able to supply the constantly increasing local demand for mules.

Very respectfully,

VICTOR A. NORGAARD,
Territorial Veterinarian.

INSPECTION AND TESTING OF IMPORTED LIVE STOCK.

Rules and Regulations.

The rules and regulations governing the importation of live stock to the Territory have, during the past year, been completely revised.

Rule 1 entitled "Inspection of Imported Live Stock" and pertaining to the duties of the agents, officers or employees of the transportation companies carrying or handling live stock, has been amended so as to allow the landing of live stock at any port of entry in the Territory instead of, as hitherto, only at Honolulu and Hilo. At the same time Rule 4, which was an amendment to Rule 1, limiting the importation of live stock to Honolulu alone, was revoked.

These changes are embodied in Rule 5, which was approved by Acting Governor E. A. Mott-Smith under date of December 30th, 1907, and which reads as follows:

RULE 5.—TO AMEND RULE 1 AND TO REVOKE RULES 2 AND 4 OF THE DIVISION OF ANIMAL INDUSTRY GOVERNING THE INSPECTION AND TESTING OF LIVE STOCK INTENDED FOR SHIPMENT TO THIS TERRITORY.

Rule 1 of the Division of Animal Industry is hereby amended by striking out paragraph 4 which reads—"Until further notice

the ports of Honolulu, Oahu, and Hilo, Hawaii, shall constitute the only ports of entry for live stock and other animals for this Territory."

Rules 2 and 4 of the Division of Animal Industry are herewith revoked, their place being taken by Rule 6.

This rule shall take effect from and after the date of its approval.

The manner of testing horse stock and cattle for glanders and tuberculosis, as defined by Rule 2, either before leaving the mainland or after arrival here, at the option of the owner or importer, has, during the past year, proved unsatisfactory. A majority of the stock, especially horses and mules, arrived here untested, in consequence of which serious results were narrowly avoided in two cases. On May 10th, the S. S. Nevadan arrived from San Francisco with 21 mules on board, untested. They were placed in quarantine and submitted to the mallein test on May 12th-13th. One of the animals gave typical reaction, but showed no physical symptoms of glanders whatever. The remaining 20 were released while the reacting one was continued in quarantine. Three days later this animal developed acute glanders and farcy and was destroyed. Notice was immediately sent to the four plantations which had bought the other 20 mules, requesting them to segregate and keep them under observation for one month. This precaution proved the prevention of at least one outbreak of glanders in a large plantation stable, for one of the 20 mules, from a shipment of six to the Island of Hawaii, developed glanders within a week after being tested, and was destroyed. Fortunately the animal was segregated when the disease manifested itself and no more cases occurred.

This importation of mules infected with glanders constituted the third of its kind to arrive from San Francisco within two years. In each of the three cases two animals were infected and the total loss was limited to the destruction of these six animals.

It is, however, obvious that under unfavorable circumstances or with the least leniency or lack of care and vigilance in the inspection and testing, the disease might have got a foothold and new centers of infection been established from each of these three importations, the losses from which and the cost of eradication could not be estimated. The uncertainty, furthermore, of never knowing whether mules or horses from the Coast would arrive here infected with glanders was very disquieting to importers. As stated in my report for last year San Francisco was known to be full of glanders and no appreciable efforts were being made by the State veterinary sanitary officials to suppress the disease. In two of the three shipments referred to, the animals, which were bought from ranches at a distance from San Francisco, had become infected while being held in stock yards in San Francisco awaiting shipment to the Islands. In one case, the second infected shipment, the animals were tested in San Francisco, and none reacted. As the disease did not manifest itself until several days after their arrival here, at which time they were carefully inspected, it is obvious that they must have caught the disease immediately before shipment. Otherwise they would have reacted and been detained.

The first infected shipment arrived here three years ago with two well-developed cases of glanders, while the last shipment became infected in San Francisco and developed the disease on the 13th day after leaving that city. These mules, as stated, had not been tested on the Coast, but had been inspected by the federal inspector of the Bureau of Animal Industry for the port port of San Francisco, who had found them apparently healthy. However, a physical examination of recently infected animals can never be anything but a farce and even the mallein test is of no value until the infection has had time to establish itself and produce definite, even though obscure, pathological changes.

It will therefore be seen that with the unsanitary conditions prevailing in San Francisco, the inspection and testing, whether

done there or here, offered but little protection. On this account representations were again made to Washington with a view to obtaining federal supervision of the shipping of live stock to this Territory, along the lines which the Federal Bureau of Animal Industry offered to exporters of horse stock to Canada.

All horse stock intended for export to Canada are mallein tested under the supervision of the Bureau of Animal Industry, while animals shipped in interstate trade must be looked after by the respective state or territorial authorities as far as testing is concerned. Considering the unique position of this Territory, 2100 miles from the mainland and compelled to obtain its draft animals from or through a state infected with glanders, it was hoped an exception might be made. I am pleased to report that toward the end of 1907 the Bureau of Animal Industry consented to allow the federal inspector in San Francisco to take charge of the testing and inspection of live stock for this Territory, and of the inspection of vessels carrying livestock, with special reference to the safe and humane installation of the animals on board. The Board of Agriculture and Forestry was advised to promulgate regulations making it compulsory to have all live stock inspected and tested by the federal veterinary inspectors before shipment. Rules were drafted and submitted to the federal inspector in San Francisco, at whose suggestion minor alterations were made before the same were presented for the approval of the Governor of the Territory.

The second case of importation of infected stock mentioned in the beginning of this chapter was a shipment of 12 dairy cows which arrived here on the S. S. Hilonian on November 1st, 1907. These animals were accompanied by a tuberculin test record, a copy of which is given below.

Owned by H. P. S———. Tested by R. M———,*M. D. C.*, at Petaluma, Cal., Oct. 17 & 18, 1907.

FOR TUBERCULOSIS.

TIME BEFORE INJECTION			TIME AFTER INJECTION, & TEMPERATURE		
No.	12 A. M.	6:30 P. M.	6:30 A. M.	11:30 A M.	6:30 P. M.
1	102 2-5	102	102	101 4-5	102 3-5
2	102	102 2-5	105	105 2-5	105 2-5
6	101 1-5	104	103 1-5	103	102 4-5
7	101 2-5	101 4-5	101 2-5	102	102
8	103	102	105	105	105 2-5
9	103	102 2-5	103 2-5	102	202 2-5 (Sic)
10	102	104	101 2-5	102	102 2-5
11	103 2-5	103	104	104	104 1-5
12	101	104	104	102 2-5	103
13	103	103	101 2 5	102	102
14	102 2·5	103 1-5	101 3-5	102	102
15	102 2-5	102 2-5	102 2-5	103	102 4-5

The above 12 young Dairy Cows were tested in our presence and sold to Alexander Young and shipped on Str. "Hilonian."

San Francisco, Cal., Oct. 24, 1907.

P——— S——— & S———.

This record was not presented to the federal inspector who examined the animals at the time of shipment from San Francisco and who, undoubtedly, would have refused shipment in case he had seen it. Under the regulations then in force the shipper had the option of having the cattle inspected and tested in San Francisco or after arrival here and the federal inspector had to content himself with a physical examination, on the basis of which he could not prevent shipment.

An examination of the record shows that two temperatures were taken previous to injection, one at noon and one at 6:30 p. m. At what time the injection was made is not stated. Neither is the make of tuberculin nor the injection given any notice.

After injection the temperature was taken three times, at 6:30 and 11:30 a. m. and at 6:30 p. m. This goes to show that the party making the test was ignorant of what constitutes a

tuberculin test or else disregarded the rules commonly accepted for the obtaining of results from which deductions as to the health of the animals can be made.

To make a tuberculin test properly or as it should be done in all cases where a certificate of tuberculin test has to be issued, the temperatures should be taken every two hours from 8 a. m. to 10 p. m. before injection. If this cannot be done, the temperatures should be taken at least at 8 a. m., 12 m. and 6, and 10 p. m. The injection should then be made at 10 p. m. The following day the temperatures should be taken at 6 or 8 a. m. and every two hours thereafter until 6 p. m.

In expert hands the process can be simplified somewhat, but a test such as the one above recorded is of no value whatever at least so far as the negative results are concerned. In examining this record we find that 8 of the 12 animals had a temperature of 103 F. or over, before injection, and that in three cases the temperature reached 104 F. The general average of these temperature would indicate that the herd was in no fit condition to be tested.

To obtain any definite information from the temperatures taken the following day, without knowing at what time the injection was made, is of course out of the question. We find, however, that two of the animals had a temperature of 105 F., or over, during the twelve hours from 6:30 a. m. to 6: 30 p. m., while two more had a temperature of 104 F., indicating a slight rise or a continuation of the high temperature before injection. That the two first animals gave undoubted reaction to the test cannot be disputed, while at least five more must be considered suspicious. However, the party performing the test allowed five hours to pass between the first and second temperatures and seven hours between the second and third temperatures, ample time in either case for the temperature to have risen and fallen several degrees.

This test record which was presented upon the arrival of the animals in Honolulu could, therefore, serve only as an indica-

tion that some of the animals were tuberculous and that a number of them were strongly suspicious of suffering from tuberculosis. The animals were, therefore, placed in the animal quarantine station and after resting for ten days were submitted to the tuberculin test with the following results.

	Nov. 9, 1907. Before injection.			Inj. 9 p. m.	Nov. 10, 1907. After injection.			
	8 A. M.	2 P. M.	8 P. M	6 A. M.	8 A. M.	10 A.M.	12 M.	2 P. M
1 Red cow branded O left side dewlap cut	101.4	101.2	102	103	102	101.8	101.4	101.2
2 Jersey, open horns	101.6	101.4	102 2	101.4	101.4	101.6	101.2	101.2
3 Dk. brown cow light red–back wht. mks. in flank, left side	101.2	101.4	102.4	103.4	104	104.2	104.6	104
4 Red cow, two white hind feet	101 6	101.4	102	101 2	101 4	101.4	101.4	101.2
5 Lt. red cow, sm'll white spots on front of hind ankles	101.8	101.6	102.8	103.2	102.6	102 3	101.8	101.6
6 Durham calico cow	101.8	101.4	102	104	104.6	104.2	103.4	103.2
7 Black cow, Dewlap cut	101.5	101.4	101.4	105.6	105.6	105.6	104.8	104.2
8 Polled calico cow	102.2	101.8	102.2	105.2	105.2	104.4	103.2	103.4
9 Black bay cow W in white hair on right shoulder	102.6	101.8	102.4	103.1	102.4	101.8	101.4	101.4
10 Red polled cow. White stripe on back, branded 18	101.8	101.8	102	102	101.4	101.4	101.2	101.2
11 Jersey calico brd. O left side								
12 Jersey, brd. LC right side. Dewlap cut	102.2	102.4	103	105.6	105.2	103.6	102.4	102
	102.4	102.2	102.8	102.1	102.2	102.2	101.6	101.4

As five of the reacting cows were heavy with calf they were not destroyed but were retested on January 10th and 11th. Again they gave typical reaction, after which three of them were destroyed and were found on post mortem examination to suffer from generalized tuberculosis. The two remaining ones were continued in quarantine for experimental purposes and were submitted to one more test a couple of months later with similar result, after which they were destroyed. On post mortem examination they also showed generalized tuberculosis.

The importer of these twelve animals is now trying to get reimbursed for his loss, but even if he does succeed in obtaining the return of the money paid for these five cows, he will still be at a considerable loss. The whole case proves strongly the necessity of compulsory testing of cattle with tuberculin before shipment from the Coast and especially that these tests be made by responsible veterinarians who understand their business. To leave the testing in the hands of local veterinarians who are regularly patronized by breeders wishing to ship stock to these Islands is naturally very unsatisfactory, as these veterinarians, in doubtful cases, will be inclined to let the local breeder have the benefit of the doubt. The only solution of the question is, therefore, to have the testing done by federal inspectors who have no private practice to jeopardize and no friends to lose by doing their duty.

As soon as the cooperation of the federal Bureau of Animal Industry had been received the following rule was promulgated and received the approval of Acting-Governor E. A. Mott-Smith on December 31st, 1907.

RULE 6.—Inspection and Testing for Glanders and Tuberculosis of Live Stock Intended for Importation.

In order to prevent the further introduction of glanders and farcy into this Territory, it is hereby ordered that:

No horse stock, (including mules and asses), shall be admitted to the Territory unless accompanied by a certificate of health showing that the animal or animals in question have been

submitted to the mallein test and found to be free from glanders. Said test must be made and certificate issued by a veterinarian authorized by the United States Bureau of Animal Industry, and endorsed by the Bureau of Inspector in charge at the port of shipment.

Any person contemplating the importation of horse stock to this Territory shall notify the Territorial Veterinarian, his assistant or the local Livestock Inspector of the approximate time of arrival of such stock, the name and address of the consignee, the name of the vessel and the port of entry.

Upon arrival of the stock the Territorial Veterinarian or his local representative shall be notified at once and the stock held as directed in Rule 1 until the same and the accompanying papers have been examined by him and a permit of landing issued.

In order to prevent the further introduction of tuberculosis in cattle it is hereby ordered, that:

No cattle above the age of six months shall be admitted to the Territory unless accompanied by a certificate of health showing that the animal or animals have been submitted to the tuberculin test and found to be free from tuberculosis. The said test must be made and certificate issued in the same manner and by the same authorities as prescribed for the importation of horse stock, and the same general rules governing the latter shall apply to the importation of cattle.

In case horse stock or cattle should be landed at a port of entry where no local representative of the Division of Animal Industry is stationed and which it would be impossible for him to reach within a reasonable time after the arrival of the stock, the owner or consignee shall be allowed to remove the animals to convenient premises where care can be taken of them and where they can be kept isolated from other stock of the same kind, upon the following conditions:

The owner or the consignee shall without delay notify the Territorial Veterinarian or his nearest representative by telephone, wireless or otherwise of the arrival of the stock and the place where he has taken them to. If so directed he shall forward the papers accompanying the stock for examination by the Territorial Veterinarian or his representative.

Until the arrival of either of these officials or until he receives notification that the accompanying papers are satisfact-

ory, the owner or consignee shall consider the animals quarantined—that is they shall be kept in a stable or enclosure where no other animals of their kind are kept and where they cannot come in contact, direct or indirect, with any such animals.

Special care should be taken that the imported animals are not watered where other stock drink, but that a separate watering place is provided or the animals watered with a bucket used for no other purpose.

No animal shall leave the stable or enclosure until officially admitted to the Territory.

If any horse stock shall be found by the Territorial Veterinarian or his representative upon arrival in the Territory to be infected with glanders or any cattle to be infected with tuberculosis, the same shall be immediately destroyed and the carcass disposed of at the expense of the owner, under the supervision of the Territorial Veterinarian or his representative.

In order to avoid the repetition of hogs arriving here affected with hog-cholera and swine plague, such as occurred last year, and in order to prevent the further introduction of sheep scab, the cooperation of the federal authorities was again invoked and resulted in the following regulation, approved to take affect on the same day as the preceding one, December 31st, 1907.

RULE 7.— Inspection of Sheep and Swine Intended for Importation.

In order to prevent the further introduction into this Territory of the diseases known as sheep scab, hog cholera and swine plague, it is hereby ordered that:

No sheep shall be admitted to this Territory unless accompanied by a certificate of health issued or approved by an officer of the United States Bureau of Animal Industry, and to the special effect that the animals are free from sheep scab or have been dipped in accordance with the regulations of the United States Bureau of Animal Industry and under the supervision of an officer of the said Board, and

No swine shall be admitted to this Territory unless accompanied by a certificate from the same authorities to the effect that the animals have passed a careful veterinary inspection, and are free from any indication of disease, especially hog cholera and swine plague, and that so far as has been possible

to ascertain no contagious disease has existed in the district whence they came.

These new regulations together with the amended Rule 1 were published in the form of a pamphlet, together with such further information as was deemed necessary for their proper enforcement. The pamphlet in question was distributed to all steamship and navigation companies carrying live stock to this Territory, as well as to all agents, breeders and others interested in the live stock industry.

From the quotation below it will be seen that this new system is not alone effective but practically without expense to the importers. All fees for inspecting and testing have been done away with and the importer is relieved of all responsibility in regard to the safe and sanitary installation of his animals on board the vessels.

The most important point in the new inspection service is, however, that the importer does not have to purchase his animals until they have been tested, as the federal inspectors will test the stock at the ranches and farms where they have been bred and raised, thereby allowing the importer to make his purchase subject to the test. In the case of horses and mules it is no longer necessary that they should be brought to San Francisco and kept there in a yard pending the test or awaiting the departure of the vessel, but can be kept at the place until ready to be taken directly on board the said vessel.

The pamphlet above referred to quotes Act 112 as printed elsewhere in this report. Also a circular letter from the Secretary of Agriculture pertaining to the shipment of live stock in interstate trade and warning the carriers of live stock against accepting for shipment any animal infected with or exposed to contagious diseases. Finally the following additional letter of information is given:

General Information Relative to the Importation of Live Stock to the Territory of Hawaii.

For the information of all concerned in the interstate movement of live stock, and more particular in the transportation and importation of live stock from the Mainland to the Territory of Hawaii, the following directions are given:

Under recent date the Federal Bureau of Animal Industry granted to the Territory of Hawaii the privilege of having live stock intended for shipment to this place inspected and tested by officers of the said Bureau. This inspection and testing with mallein or tuberculin will be made either at the port of shipment or at the farm or ranch where the animals are to be purchased, and will be made free of charge as far as the services and the mallein and tuberculin are concerned. All other expenses, including traveling expenses and subsistence of the inspector to and from the place where the test is to be made, must be paid by the party ordering the test. The federal inspectors will also inspect each vessel carrying live stock to this Territory and see to it that the animals are installed on board in such a manner as to insure their safe and humane transportation.

Any party desiring to purchase on the Mainland of the United States, horse stock or cattle for shipment to this Territory or any party having purchased such animals should apply to Dr. George S. Baker, Inspector in Charge, Bureau of Animal Industry, 407-8 Post Office Building, San Francisco, California, for inspection and testing. In case the animals are located at a distance from San Francisco, Dr. Baker will send one of his inspectors to make the test or will designate the nearest inspector to whom to apply for testing. Upon arrival of the stock in San Francisco, Dr. Baker should be notified and the test certificates submitted for his approval, unless they have been forwarded to him direct. He should also be informed as to the vessel on which the animals are to be shipped and the date and time of sailing.

SPRAYING IMPORTED CATTLE FOR LICE AND MANGE.

The same directions apply as far as inspection is concerned to sheep and swine intended for importation.

Inspection for Parasitic Skin Diseases in Cattle.

During the past two years it has been noticed that some of the cattle which arrived here were affected with warbles in the back, a disease due to the presence under the skin of the larvae of the ox warble-fly or heel-fly. This disease will be found fully described under the chapter relating to "Insects Affecting Domestic Animals in the Territory" and is only mentioned here because the appearance of these parasites in imported breeding stock has necessitated the careful examination and treatment of the animals before allowing them to proceed to their destination on the various ranches.

As parasitic skin diseases cause great loss to the live stock industry in the States, it is of importance, so far as possible, to keep them out of the Territory.

All imported breeding stock has, therefore, during the past year been examined for warbles in the back, and in all cases where they have been found, the parasites have been destroyed and the owners instructed to submit the cattle to an examination every two or three weeks in order to discover and destroy such parasites as may develop after arrival. This examination must be continued for five or six months, which is the time required for the development of the larvae.

On account of this protracked development of the parasite in question, it has not been found convenient to promulgate an official regulation on the subject, but the attention of importers has been called to the importance of keeping this parasite out of the Territory, and it has been explained to them that this can only be done through their own individual efforts.

Cattle mange and lice, which are responsible for much damage to live stock in the States, do not seem to thrive here, possibly on account of the climatic conditions and the general presence of green food during the entire year. Nevertheless,

all breeding stock which has arrived during the past year has been submitted to a disinfecting bath, consisting of a two per cent solution of creosotic or carbolic dip, applied with a spraying pump and rubbed into the skin with a stiff brush. (See illustration page.)

Results from Inspection Service.

As a result of the inspection and testing of live stock before shipment, the following undesirable importations have been avoided:—

12	bulls	reacted	to	the	tuberculin	test.
6	mules	"	"	"	mallein	"
6	horses	"	"	"	"	"
1	jack	"	"	"	"	"

The twelve bulls were tested in four different States,—California, Oregon, Nevada and Montana. All of them were high-priced animals and would, if they had been imported without the test, proved a total loss to the owners, as they undoubtedly would have reacted upon arrival here. Without a test at either end the consequences are not pleasant to contemplate.

The thirteen head of horse stock which reacted to the mallein test were all located in California.

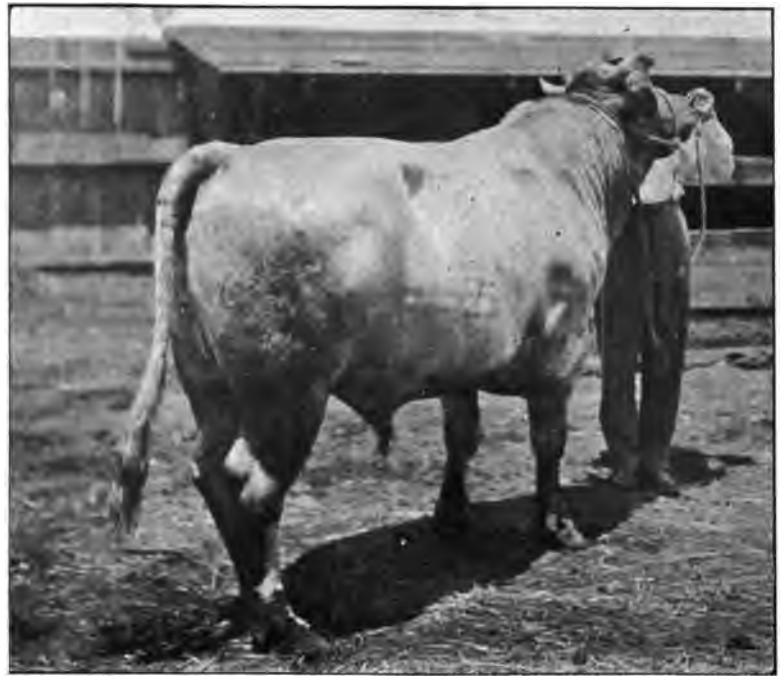
Of the animals which arrived here untested, or which were retested here, five cows were destroyed for tuberculosis and two mules for glanders.

Sixty head of imported cattle were treated for warbles and cattle mange.

Importation of Live Stock.

During the year of 1907 there arrived in the Territory the following live stock, poultry and dogs:—

Horses (7 stallions)	139
Cattle	167
Mules (8 jacks)	493



SHORTHORN BULL IMPORTED BY MR. A. W. CARTER FOR THE PARKER RANCH, HAWAII.

Swine	394
Sheep	56
Dogs	22
Poultry (crates)	160

Owing to the fact that during the greater part of 1907, the Board had no inspector stationed in Hilo, the importations for the year are given as a total for the Territory and not, as in the preceding years, with special reference to the port of entry.

All of the above stock came from the Mainland of the United States with the exception of five dogs, which came from foreign ports.

Horses. A scarcity of horses prevails in the Territory and prices have consequently gone up to a considerable extent.

Seven stallions were imported, only one of which was a heavy draft animal (Percheron). As heavy draft animals are needed more than any other horses in these Islands, it is to be hoped that the coming year will see the introduction of more draft animals for breeding purposes.

Among the rest may be mentioned two German coach stallions, two large well bred trotting stallions and one aged, but well bred, running stallion. As neither trotters nor runners are bred here (the trotting sport is unknown and running races only indulged in to a very slight extent) the latter animals were possibly introduced with a view to improving the cow ponies, so that some time in the distant future, the resulting mares may be used with additional importations in the production of road horses, for which there is a limited but constant demand.

The remaining imported horse stock were, with the exception of a few choice carriage and saddle horses, very ordinary. One shipment of twenty-two mares, imported for mule breeding, had some very good animals among them, but, taken all together, the importation of horse stock during 1907, so far as quality is concerned, was far below what might be desired.

There are less good horses in Honolulu than in any other city in the United States of the same population and wealth and

there is less interest taken in horse flesh than in almost any small city on the mainland which is the more remarkable as there are excellent roads and beautiful drives in and around the city.

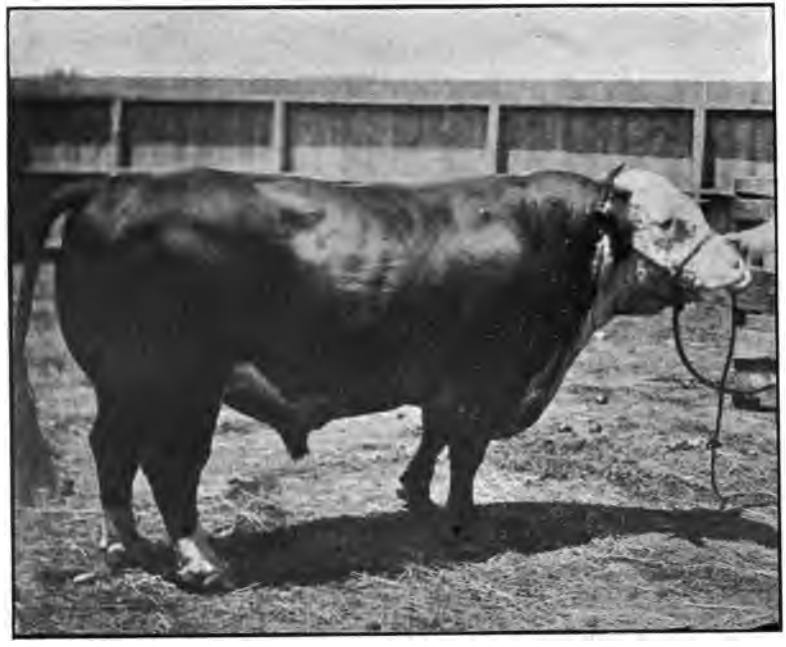
An animal fair for the exhibition of live stock, supported by the Territory and the counties, would, no doubt, help to revive the interest in horse breeding and keeping, both for sport and utility.

Cattle. Of the one hundred sixty-seven head of cattle imported during 1907, only twenty-one head were dairy cows, the remaining being all breeding stock, and, with the exception of one importation, all registered stock. The predominant breed was Hereford, but a number of good Short-horns, both bulls and heifers, were imported. Some of the Hereford bulls were prize-winners and will, no doubt, leave their mark on the herds of the ranches by which they were imported. The accompanying pictures fully show their quality.

This year's importation is far in excess of that of the previous year (71 bulls) and there is every indication that the coming year will see a still greater number of good cattle brought to the Islands.

Mules. Four hundred and eighty-five mules were imported during 1907, as compared to two hundred and ninety-five during 1906, and two hundred and forty-five in 1905. The animals, as a general rule, were younger and of better quality than those of the immediate preceding years, but the prices were higher than ever before. At a conservative estimate the average cost was $245 per head, landed in the Territory, or an aggregate of $118,825.

The great increase in the number imported is, no doubt, due to the fact that many plantations refrained from buying mules on account of the high prices until they were absolutely forced to do so, and there is little doubt that the coming year will see still greater importations in this line, as a large percentage of the mules on hand are getting old and decrepit.



HEREFORD BULL IMPORTED BY MR. A. W. CARTER FOR THE PARKER RANCH, HAWAII.

The high price of mules will, without question, remain unchanged for several years to come, as the demand for these animals on the mainland seems to be increasing steadily. Relief must, therefore, be looked for from the breeding and raising of mules in the Territory, and the importation of eight jacks would seem to indicate that a serious attempt is now being made to make the mule industry a factor of importance in the Islands. (See chapter on "Mule Breeding in the Territory.")

Swine. Only two shipments of swine for butchering came to the Territory during 1907. The total number imported was 394 head, as compared to 3359 during 1906 and 2132 during 1905.

Two shipments of butcher hogs, aggregating 350 head, arrived respectively in March and November and proved unprofitable on account of the prices which had to be paid for them in San Francisco. Forty-four swine, divided nearly equally between sows and boars and nearly all of them Berkshires, were brought in for breeding purposes.

The type of swine most commonly met with in the Islands is one closely related to the "razor back." With the splendid market for hogs in Honolulu, it would seem a paying investment to import good breeding stock and to raise pure-bred hogs for sale in the Islands. Berkshires have proved very satisfactory here and there is a strong demand for good breeding stock at all times, but the small breeder is always reluctant to take the trouble of sending to the Coast for animals, while he would be willing to buy if he could see and select the animals he needs.

Sheep. Fifty-six head of sheep, all Shropshires, arrived during the year. They were all first-class animals, but their number is ridiculously small when the number of sheep and the importance of the sheep and wool industry in the Territory is considered. The failure of large importations of sheep is, to a certain extent, due to the fact that the three principal sheep ranches had ordered rams from New Zealand, which failed to

get here for want of transportation facilities. There is every prospect that those animals, which aggregated about 100 head, will be brought in during the coming year.

Dogs. Of the 22 dogs which were imported, two came from Japan, one from Vancouver, and two from New Zealand; the rest coming from the mainland. The majority of them were pets and only a very limited number were imported for the purpose of improving the strains already here or for the sake of introducing new breeds.

Poultry. The importation of 160 crates of poultry, among which were a great number and variety of fine birds, shows that the interest in the poultry industry is on the increase. This is, no doubt, due in a great measure to the very successful poultry shows which have been held during the past two years. Pure bred poultry has proved a satisfactory and profitable investment to nearly all of the importers. Quite a number of people in Honolulu have taken up the breeding of fancy chickens and it is to be hoped that this interest will continue and spread to the other Islands.

IMPORTATION OF DRESSED MEATS AND DAIRY PRODUCTS.

Perhaps the best information in regard to the lines along which the live stock industry of the Islands should be developed can be obtained by considering the class, nature and value of live stock products consumed but not produced here. The following figures, which represent the importations of a single Honolulu firm during the year of 1907, will undoubtedly come as a surprise to many of the local breeders, dairymen and poultry-raisers, representing as they do only a fraction of the total importations to the Territory:

Importations made by one Honolulu firm during 1907.

	No.	Weight.	Value.
Dressed sheep	5,800	229,637 lbs.	$ 23,451.36
Pork loins	3,234	35,477 "	5,830.14
Dressed chickens	11,436	44,732 "	10,040.79
" turkeys	3,050	35,420 "	8,330.69
Butter		253,433 "	80,607.10
Cheese		17,408 "	3,494.34
Eggs	45,120 dozens		12,028.66
		Total value	$143,783.08

To elaborate on these figures is unnecessary. Anybody producing or interested in any of the above mentioned items can see for himself that no fault can be found with the local market. The demand is here at all times, and the failure to supply it most be sought in a lack of rational methods. To raise sheep, hogs and poultry here in sufficient quantities to do away with importations from the Mainland and the Colonies should not be an impossibility, and to solve this problem, as well as that of the local dairy industry, which seems to be fighting against overwhelming odds, would seem to be one of the most important tasks for the U. S. Agricultural Experiment Station to take hold of. The present apparent failure cannot be attributed to unfavorable conditions, whether climatic or sanitary. The climate compares favorably with that of any State in the Union, and the Territory is singularly free from nearly all of the ravaging animal diseases of both the old and the new world. True, we have diseases among the live stock but the extent of the losses resulting from them is in nearly every instance due to a lack of rational methods in breeding, feeding and care. The thrifty animal is always healthy, while the inbred, underfed and weakly animal invites and spreads disease.

The solution of the problem before us must therefore, in the writer's opinion, be looked for from the agriculturist, the animal husbandman, and the agrostologist, and only in a secondary line from the Territorial Veterinarian.

IMPORTATION OF LIVE STOCK FROM NEW ZEALAND.

As indicated in my report for last year, permission was obtained from the Federal Government in Washington for the importation of a limited number of bulls and rams from New Zealand, the same to be pure-bred stock. In consequence thereof a number of stock raisers in the Territory decided to purchase bulls and rams from New Zealand, the orders being placed with Mr. George C. Munro, formerly manager of the Molokai Ranch, who was at the time returning to New Zealand. This was during the month of May.

The orders placed with Mr. Munro aggregated 28 bulls and 95 rams, the prices ranging from $250 per head for bulls down to $100 per head for yearlings, while the ram prices ranged from $20 to $35 per head. The orders included Herefords, Short-horns, Angus, and Holstein bulls, and Merino and Shropshire rams, and twelve different breeders participated in the projected importation.

In order to facilitate matters as much as possible with Mr. Munro, the following letter was addressed to the Secretary of Agriculture of New Zealand:

Honolulu, Hawaii, June 21, 1907.

The Honorable John D. Ritchie,
Secretary of Agriculture,
Wellington, New Zealand.

Sir:—

I beg to call your attention to the fact that through special permit from the Secretary of Agriculture for the United States an importation of breeding stock from New Zealand to this Territory has been authorized.

Mr. George C. Munro, who for a number of years managed one of the largest ranches in this Territory, is the authorized agent for the breeders who wish to import fresh blood, and his present address is Clevedon, Auckland.

The first importation will consist of 22 head of pure-bred bulls of various breeds and 80 head of rams, Merino and Shropshires.

Through its representative here the United States Department of Agriculture will watch with interest the result of this importation, and, as the Territorial Board of Agriculture feel convinced that great benefit to the local live stock industry may result from the introduction of good strains of pure-bred animals from New Zealand, I would respectfully suggest that you direct the Veterinary Division of your Department to assist Mr. Munro in selecting the animals from districts which are known to be free from infectious or contagious diseases and to help him locate the class of animals which he has been instructed to buy. Also to see to it that he obtains clean and disinfected cars for transportation to Auckland.

Thanking you beforehand for any effort on your part in making this importation a success, I beg to remain,

Very respectfully,
(S) C. S. HOLLOWAY,
President and Executive Officer.

In reply to the above the following was received:

Department of Agriculture,
Head Office, Wellington,
29th July, 1907.

The President and Executive Officer,
Board of Commissioners of
Agriculture and Forestry,
1438 South King Street,
Honolulu, Hawaii.

Sir:—

With reference to your letter of the 21st ulto., stating that it is the intention of the Territorial Board of Agriculture to import breeding stock from New Zealand to your Territory, I have the honour to inform you that this Department will render to Mr. Munro every assistance possible in selecting the animals, and in any other direction he may desire.

I may state that this Colony is happily free from any infectious or contagious disease amongst stock.

I have the honour to be, Sir,
Your obedient servant,
(S) JOHN D. RITCHIE,
Secretary.

In the meantime Mr. Munro had located and arranged for the purchase, inspection and testing of all of the animals, the same being held on the various farms where bred until transportation could be obtained for them. The Oceanic Steamship Company had withdrawn its boats running between San Francisco, Honolulu and New Zealand, while the Canadian-Australian Steamship Line did not touch at New Zealand, but picked up passengers and freight from New Zealand at Suva. To ship by this line would, therefore, have necessitated unloading the stock at Suva, and to this the Federal authorities could not agree. There was consequently nothing left but to try to get transportation for the stock on a tramp steamer and in no case did Mr. Munro receive notice of the departure of such steamer in time to get his shipment together.

As a result of this none of the animals have arrived here up to the date of this writing and a number of the breeders have withdrawn their orders and imported stock from the States.

Another effort is now being made to arrange for an importation of bulls and rams from New Zealand during October, November, or December of 1908, Mr. Munro having been assured that one or two steamers will leave New Zealand for Honolulu during those months. A number of orders have been renewed and it is to be hoped that the importation will materialize this time.

For the information of prospective importers of live stock from New Zealand it may be well to add that under the rules of the Bureau of Animal Industry of the United States Department of Agriculture, cattle must be quarantined for 90 days from the time they leave New Zealand, while sheep are quarantined after the date of arrival. Further, that cattle are not to be admitted here unless registered in one of the stub-books recognized by the United States Department of Agriculture.

Mr. Munro has been furnished with full information on all of these points and in case any of the breeders of the Territory

desire to correspond with him in regard to the purchase of animals to be included in the above mentioned shipment, his address is as follows: "George C. Munro, Ruatangata, Whangarie, Auckland, New Zealand."

DISEASES AMONG LIVE STOCK IN THE TERRITORY.

Taken all together there has apparently been less disease among the live stock during the past year than during the two previous years. The diseases which have been of most importance are here dealt with under separate headings and those discussed in my previous reports will only be referred to as circumstances demand.

Osteoporosis or *Big Head* in *Horses.* The past year seems to have been unusually favorable for recovery from this disease, at least in certain sections. One plantation manager, who has suffered severe losses from this disease and who had a number of cases on hand which were considered hopeless, informs me that they have all taken a turn for the better, some recovering completely and all improving sufficiently to go back to work. The writer has known some of these animals, nearly all saddle horses, for more than two years, and considered them beyond recovery. Some that could hardly walk were shot and the rest allowed to live under apparently the same circumstances and surroundings as when they developed the disease. Treatment with bonemeal and iodide of potash had long since been abandoned when improvement began. The said manager, who has been watching the cases closely, is unable to furnish any information or suggest any cause for this sudden turn for the better. He only regrets that any of the affected animals were killed.

This information is given as it was received and it is left to the owners of the big head horses to draw what comfort they can from it. The writer has had no opportunity to personally inspect the animals in question, but feels assured that the facts as given are correct. Such spontaneous recovery of osteoporosis

is not impossible and would furnish an explanation for many of the wonderful cures reported as resulting from certain medical or sanitary treatments.

Osteomalacia in *Cattle.* Little new has developed in regard to the bonemeal treatment during the past year. On the ranches, farms and in the dairies where it has been used regularly it has given perfect satisfaction. On one large ranch where the disease was very prevalent it has disappeared completely and the treatment, at first very expensive on account of the quantities of bonemeal eaten by the affected animals, has been reduced to minimum cost.

It is therefore strongly advised that live stock breeders in all sections where the animals do not thrive or develop in a satisfactory manner, have the soil and the vegetation of their pastures chemically analyzed to ascertain whether they contain the requisite amount of phosphates and lime, and that, if deficient in these ingredients they adopt the bonemeal treatment as described in previous reports.

Red Water in *Cattle.* The writer regrets to state that he has found it impossible during the past year to give the time to this important subject that it demands. A number of post-mortem examinations of animals affected with the disease have been made at the slaughter houses in Kalihi and the diseased tissues studied in the laboratory. As a result of these investigations there is no doubt in the writer's mind that the disease is of parasitic nature. There is now in the laboratory a large collection of specimens awaiting sectioning and further microscopic investigation, and this work will be given precedence over all other outside of routine work. An effort has been made to secure all the literature covering the subject of hematuria in man as well as in the domesticated animals, though the results already obtained warrant the conclusion that the disease so prevalent among the human race in certain countries is not identical with the one observed here among cattle.

ACTINOMYCOSIS (Lumpy Jaw) IN CATTLE.

Although this very common bovine disease has not been discussed in any of my previous reports, economy of space forbids a detailed consideration of it here. Furthermore, every cattleman is more or less familiar with its appearance and those who are not must be referred to the "Special Report on Diseases of Cattle" (U. S. Department of Agriculture) pp. 427-436.

The reason why it is mentioned here is that the disease seems to be very much on the increase in the Territory, and may almost be said to have become endemic on certain ranches. It is therefore only right to sound a warning in order to prevent its further spread.

It appears that on one ranch where the disease has hitherto been comparatively rare, at least a dozen cases developed simultaneously and rather suddenly. The cause for this sudden influx of infection cannot be determined, though it may possibly have resulted from the introduction of new and more virulent germs with imported bulls which developed the disease after arrival. If such is the case, it may be taken for granted that the recent development of a considerable number of new cases, many of which have been of the acute type with large abscesses that soon break open and scatter the infection over the pastures, is attributable to the same virulent form of infection. It would therefore seem wise, for the present at least, to consider all lumpy jaws as affected with a contagious disease and to act accordingly.

The first step would therefore be to segregate the affected animals. The next would be to separate them in lots according to their class and value, either as beef or breeding animals, and then to divide each lot according to the nature of the lesion. If the latter affects only the soft itssues of the throat and lower jaw the disease is, in a majority of cases, amenable to treatment. If the disease has affected the bones of either the upper or lower jaw, the case may safely be considered incurable.

All affected animals which are in fair to good condition (with the exception of valuable breeding stock) should be disposed of with as little delay as possible, either by shipping them to market or by butchering them for local consumption. The old superstition that the meat from a lumpy jawed animal is unfit to eat, or in any way inferior to that of unaffected animals of the same class and condition, has long since been dispelled. In support of this statement the following quotation from Bureau of Animal Industry Order, No. 150, entitled "Regulations Governing the Meat Inspection of the United States Department of Agriculture," (issued and effective April 1, 1908) is hereby appended:—

Actinomycosis or Lumpy Jaw.

SECTION II. *Paragraph* 1. If a carcass affected with actinomycosis or lumpy jaw is in a well-nourished condition and there is no evidence upon post-mortem examination that the disease has extended from a primary area of infection in the head, the carcass may be passed, but the head including the tongue shall be condemned.

Paragraph 2. Carcasses of animals showing uncomplicated localized actinomycotic lesions other than, or in addition to, those specified in paragraph 1 of this section may be passed after the infected organs and parts have been removed and condemned.

Paragraph 3. Carcasses of animals showing a generalized actinomycosis shall be condemned.

From the above will be seen that unless a carcass is emaciated or affected with generalized actinomycosis it is passed by the Federal inspectors as fit for human consumption, after the affected organs have been removed.

Prof. Ostertag, Chief of the German meat inspection, and recognized the world over as the first authority on this subject, goes still further in that he only condemns the affected organs

"in so far as the removal of the specifically altered parts is not possible. This is the case in isolated foci in the tongue, and the removal of the diseased parts for the purpose of releasing the rest of the tongue is very desirable, since the tongue is so valuable an organ."

In regard to the lumpy jaws which are either too valuable to be destroyed or else not in condition to be butchered the point to be considered is whether their lesions are of such a nature that they are, or may become, liable to scatter the infection, or whether they may safely be kept for some time in a fattening paddock, or submitted to treatment.

In order to determine what course to pursue in each individual case, it will be necessary to briefly discuss the nature of the various lesions.

Soft swellings and tumors which are not attached to or connected with the bone, must be divided in two classes, (1) those which have already broken open and discharged their contents of pus and healed up again and (2) those which have not yet ruptured, that is, which are covered with unbroken skin, showing no scars.

Animals exhibiting the first kind of tumor may, as a rule, be placed in a fattening paddock with unaffected animals without any danger of their spreading the disease. In case the pus has been discharged, and the pus cavity has been filled with soft cancerous tissue which protudes like a mush-room through the opening, the animal should be submitted to the iodide of potash treatment until the soft tissue has completely disappeared, the wound healed and the tumor considerably reduced in size.

Tumors covered by unbroken skin are liable to rupture at any time and it is therefore not safe to turn animals so affected out until they have been submitted to treatment. This should consist in a deep insertion into the tumor, syringing out with antiseptic solution, packing with cheese cloth or cotton soaked in tincture of iodine, and the iodide of potash treatment given internally.

In operating on these tumors care should be taken to destroy all discharge where it falls on the ground, in order to prevent the scattering of the germs with wind and dust.

When the bone is affected it should be determined by careful manipulation whether there is any likelihood of the swelling breaking open. If the swelling seems to be solid and the skin is not attached to it in any particular spot but can be moved freely over the surface of the swelling, there is little likelihood of a rupture for several weeks, but if such animals are turned in with other unaffected animals, it would be well to submit them to a careful examination every two or three weeks. If an attachment forms between the skin and the bony swelling, it is an indication that pus is forming underneath and that perforation of the skin will soon take place. When this condition is noticed it is best to butcher the animal.

Valuable breeding animals should be dealt with along the same lines, except that they should be submitted to treatment, whether surgical, medicinal or both, without any delay.

GLANDERS.

This disease has, as usual, caused considerable loss, two, large outbreaks with respectively 10 and 12 cases, having occurred, besides a number of scattering cases, principally on Hawaii and Oahu.

As stated in my report for last year, glanders had broken out during the latter part of 1906 among the horses belonging to a Chinese rice company near Honolulu. Two animals were destroyed and of the remaining, 22 head gave typical reaction to the mallein test. As these 10 animals showed little or no clinical symptoms of glanders and as the company was in the middle of the rice harvest it was decided not to destroy the reacting animals, but to segregate them from the healthy ones and to quarantine that part of the premises on which the reacting animals were kept and were being worked. These 10 animals were branded conspicuously on both sides of the rump

with a brand consisting of two letters T and V connected at the top and the police authorities were requested to arrest any person leading or driving any of the animals so branded, when found outside of the premises on which the animals had been quarantined. The company's stables were visited regularly to see that the instructions as to the segregation of the animals were being carried out and to watch for the appearance of fresh cases.

As soon as the rice was harvested and the new crop planted, all of the horses were again submitted to the mallein test with the result that the 10 branded animals reacted again, while none of the remaining ones showed any rise of temperature.

This result speaks well for the accuracy of the mallein test,—six months having elapsed between the first and second test.

The reacting animals were destroyed and all showed on post-mortem examination lesions of chronic glanders, either in the nose or in the lungs.

With the assistance of the Territorial Board of Health the premises were then thoroughly disinfected and released from quarantine.

During the month of July, 1907, information was received that glanders was prevalent on one of the plantations in the Hamakua district on Hawaii. Upon inquiry it was learned that the manager of the said plantation had reported the matter to his agents in Honolulu and requested that the Territorial Veterinarian be notified of the outbreak. This was, however, not done, and when approached on the subject as to why the outbreak had not been reported, the officer in charge stated that the manager of the said plantation knew as much about glanders as any body else and that he considered him fully capable of dealing with the outbreak without the assistance from this office.

As the agents in question were violating the rules and regulations of the Board of Agriculture and Forestry the matter was immediately laid before the said Board with the result that the Assistant Territorial Veterinarian was instructed to proceed to

the plantation in question in order to make an investigation. The Board further decided that owing to the failure of the agents to report the outbreak all of the expenses in connection with the investigation should be borne by them and not paid for out of the public funds.

In order to impress upon the agents and the managers of plantations and other corporations owning or using horses or mules, the necessity for promptly reporting the presence of glanders among them and further to remind them that the presence of this disease is not alone a menance to their own stock but also to that of neighboring plantations and ranches, the following letter from the President of the Board of Agriculture to the agents in question is quoted:

"Gentlemen:— I am directed by the Board of Commissioners of Agriculture and Forestry to address you relative to the presence of glanders on the premises ——— Hawaii.

On the 16th ult., information reached this Board to the effect that this disease was prevalent among the horse stock on this plantation. It further developed that the manager of the said Sugar Company had reported this fact to your office two weeks previously, fully expecting that you would notify the Territorial Veterinarian, as prescribed by the law. (See Rule III, Division of Animal Industry, entitled "Concerning glanders in horse stock in the Territory") copy of which is enclosed herewith.

Having ascertained from you that the information above referred to was correct, this Board instructed the Assistant Territorial Veterinarian to proceed to ——— for the purpose of investigation. Upon his return to Honolulu, this official reported that he had found five insipient cases of glanders, all of which he destroyed.

A total of 153 animals were submitted to the mallein test without which at least four of the cases referred to could not have been diagnosed. He further reported that three animals, presumably suffering from glanders, had been killed previous to his arrival, and that a considerable number had either died or been destroyed, off and on during the past two or three years.

It is unnecessary to call your attention to the fact that the continued presence for years in any one locality of a highly infectious and contagious disease, such as glanders, a disease

which is transmissible to man with invariably fatal result, is a constant menace to horse stock on neighboring plantations and ranches, as well as to human beings, and furthermore in strict violation of the Territorial laws which provide a penalty not to exceed Five Hundred Dollars ($500.000) for its violation.

That glanders has occurred recently on the ——— Plantation can hardly be doubted, and considerable uneasiness is felt in other neighboring districts in regard to the possible spread of this disease.

While the Commissioners have full powers to prosecute the persons at fault, in this instance it has not been deemed advisable, under the circumstances, to take such action, but they request that you instruct the managers of the plantations for which you are agents, to acquaint themselves with the regulations of this Board, copies of which are enclosed, and that you as well as the managers be guided thereby.

It is the opinion of the members of the Board that all expenses incurred in connection with this investigation should be paid by the ——— (the company in question.)

During September of the same year a letter was received from this plantation stating that two of the mules which had been tested by Dr. Fitzgerald on his first trip to that place were showing suspicious symptoms. Dr. Fitzgerald was again sent to Hawaii and on his return reported that he had retested 13 suspicious mules but that none of them had given sufficient reaction to warrant their destruction. While there, Dr. Fitzgerald received information to the effect that there were a number of sick mules in Waipio Valley wherefore he proceeded to that place to investigate. He found 9 cases of acute glanders, all in mules belonging to a Chinese rice planter. All of these animals were destroyed and the remaining mules belonging to the same party were placed in quarantine in a separate pasture.

Dr. Fitzgerald also ascertained that a larger number of horses and mules had been dying from glanders in the Waipio Valley during the last few weeks before his arrival, and, considering that nearly all of the animals from this valley are used to carry rice and paiai all over the Hamakua districts from Kamuela to Paauhau, the situation was sufficiently serious to warrant

that steps be taken without delay to prevent the further spread of the disease.

A wireless message was sent to the Parker Ranch requesting that no horse or mules from Waipio Valley be allowed to pass the Hamakua gate and that the pack train which once a week brings paiai to the Parker Ranch and to the stores at Kamuela be met with wagons at the said gate. At this place the provisions were transferred from the pack animals to the wagons and the pack train instructed to return immediately to Waipio Valley and remain there until further notice.

On September 17th I left in person for Kawaihae and proceeded immediately to Kukuihaele. Unfortunately my arrival had been telephoned to Waipio Valley with the result that a large number of animals had been led up the trail on the other side of the valley, where I was informed it would be impossible to find them without a complete round up of the various gulches and the plateau between Waipio and Waimanu valleys. I, therefore, decided to leave these animals alone for the time being and to confine myself to an examination of the horse stock which remained in the valley. It is unnecessary to state that no more sick animals were found, although I was assured that there were plenty of them left, if only they could be located.

Owing to this condition, which at that time I was unable to deal with, I had decided to quarantine the entire valley, but I found that this would be too much of a hardship on the inhabitants and I consequently confined myself to the issuing of permits for the animals which I found to be sound and the quarantining of all of the animals belonging to the rice company among which the disease was known to exist.

In carrying out these instructions I received every assistance from the manager of the Kukuihaele plantation, who instructed his stable luna, who had accompanied me on my trip of inspection in the valley, to watch all of the animals coming out of the valley and to report to me immediately in case any of the mules belonging to the said rice company should be brought up or in

case any suspicious looking horses or mules should be found in the neighborhood. All watering troughs on the public roads in the district were turned over and a close watch was kept to see that no outside animals should approach any of the plantation watering troughs.

As I was hard pressed for time I returned to Honolulu with the intention of coming back as soon as possible to make a thorough investigation of the Waipio district. This trip was, however, delayed until the begining of December when an outbreak of glanders in Hilo was reported.

Dr. Fitzgerald was sent to investigate this outbreak and to assist the local veterinarian, who had direct charge of the live stock on the plantation in question. Two animals were destroyed here, after which Dr. Fitzgerald was instructed to proceed to Kukuihaele for the examination of the animals in Waipio Valley.

On his return to Honolulu Dr. Fitzgerald submitted the following report:— "I left Hilo for Kukuihaele on December 11th and immediately proceeded to organize a party to accompany me into and beyond Waipio Valley. I succeeded in getting together three cow-boys, one interpreter and two policemen, with whom I went into the valley on the 12th. On the 13th and 14th we rounded up all horse stock in Waipio valley, a total of 192 head. Among these there was one case of acute glanders which was destroyed, while 16 animals were slightly suspicious. These all submitted to the mallein test, but as none of them reacted they were released.

On the 15th we went up the trail on the further side of the valley and rounded up the entire plateau including the 12 gulches located there. We found only 10 horses, one of which was affected with glanders and was destroyed. The 16th was spent in Waimanu valley where 30 animals were examined and one destroyed for glanders. We then returned to Kukuihaele and on the 17th and 18th rounded up and inspected all of the outside animals in the neighborhood, as well as all of the plantation stock. Among the outsiders one case of glanders was found and destroyed. After examining the plantation stock of Hono-

kaa, which was found to be free from the disease, I returned to Honolulu."

This investigation cannot be considered conclusive. There is undoubtedly still glanders in the neighborhood and until a veterinarian is stationed permanently in that district, its complete eradication cannot be expected. The office of Territorial Veterinarian has, during the past year, had so many duties heaped upon it, that it has been impossible for one of the members of the staff to be absent from Honolulu for any length of time and it is, therefore, to be hoped that the plan of appointing Deputy Territorial Veterinarians, as outlined elsewhere in this report, will meet with the required support of the plantations and ranches of the other islands.

In Honolulu and vicinity a number of cases of glanders have occurred during the past year. One of these cases occurred, as already stated, among a shipment of 21 mules which arrived here on the S. S. Nevadan on May 10th, 1907. The mules were submitted to the mallein test on the 12th and 13th, one mule giving typical reaction. On careful examination no physical symptoms of glanders could be discovered and as the animal had shown a comparatively high temperature before injection, the feverish condition was considered as being due to shipping fever. Nevertheless the animal was placed in quarantine, while the remaining 20 animals were released. The mule was seen again two days later, on the 15th, when it had developed swollen lymph vessels and nodules on the left shoulder and the front of the chest. The followinng day profuse discharge from both nostrils appeared, the animal showing every indication of acute glanders and farcy. In the meantime the other mules had been shipped to various plantations on Oahu, Kauai and Hawaii and, as there could be little doubt that these animals must have been exposed to the same infection as the one which developed the disease, no time was lost in notifying the various purchasers of the facts in hand and instructing them to segregate the animals and keep them under observation for a month. A week later

information was received from a plantation on Hawaii, which had received six of the animals in question, that one of them had developed glanders and had been destroyed. This animal had fortunately been segregated before the symptoms developed and no further cases occurred.

One of the other cases which occurred in Honolulu is of interest because it demonstrates the danger in allowing empirics and unqualified horse doctors to practice veterinary medicine and to represent themselves as qualified to do so.

On December 21st, 1907, this office was notified by a person living in Palama that a horse which in his opinion was suffering from glanders had for several days past been tied in an empty lot in the neighborhood of the Palama Fire Station. Upon investigation the animal was found tied to a fence in the public road one block mauka from King Street and diagonally opposite the Fire Station. Upon examination it was easily observed that the animal was suffering from glanders in an advanced stage. The owner was located and sent for and when charged with keeping a glandered horse and not reporting the same to the Territorial Veterinarian, he claimed ignorance as to the serious nature of the disease, but stated that he had called one Dr. ———, who had seen the horse the day before and had stated that the animal was possibly suffering from glanders. From the appearance of the horse it was evident that it had been under treatment for several days, as excoriations, such as those resulting from the application of strong liniment or blister, were observed on both sides of the face and on the under side of the lower jaw. It further developed that the same ———. had seen the horse several days previously and had furnished the medicine which had been applied to the sick animal.

As the horse exhibited every symptom of acute glanders, including deep ulcerations on the lower part of the septum where they could easily be observed even on casual examination, there can be no doubt that the said ——— either did not know a case of glanders when he saw it, or else willfully neglected to

report it to the proper authorities, or to take any precaution whatever to prevent the spread of the disease.

The horse was immediately removed to the animal quarantine station in Kalihi and the following morning was destroyed in the presence of three of the qualified veterinarians of Honolulu besides myself. All of us agreed after careful ante-mortem and post-mortem examination that the animal was suffering from acute glanders to such a pronounced degree that any person, whether lay or professional, having any experience at all with horses must have recognized the case as one of glanders or at least have considered it highly suspicious of the disease.

OBSERVATIONS REGARDING GLANDERS ON THE ISLAND OF HAWAII.[1]

By H. B. Elliot, M. R. C. V. S., Hilo, Hawaii.

[1] The above interesting paper regarding glanders on the Island of Hawaii has been contributed by Dr. Elliot of Hilo, whose long experience with the disease under consideration, makes his observations of value to all owners of horse stock.

As Dr. Elliot is now an officer of this Board, having been appointed Deputy Territorial Veterinarian under date of March 1st, 1908, and as I can fully endorse the recommendations made by him I take pleasure in having his observations appear at this place. —V. A. N.

The early history of glanders on this island is enveloped in obscurity, but we are told by "kamaainas" of a distemper which, during the first years of the establishment of the sugar industry, caused severe losses among the plantation animals. This distemper was, from the discriptions given to the writer by eye-witnesses, undoubtedly glanders. We have no definite evidence that this disease existed prior to the introduction of the sugar industry, but certain facts, which we cannot discuss at the present moment, suggest that it may have been prevalent among the Hawaiian stock for a very considerable period of time.

At the time of my arrival, the latter part of 1895, on this island, the administration of the laws regarding contagious diseases among animals was vested in two "Boards of Live Stock

Inspectors," supposed to be under the supervision of the Ministry of the Interior. One of these boards was situated at the port of Hilo, the other in the district of Kohala. There were no qualified veterinarians on the island and this system was, perhaps, the only practicable one under the circumstances. The fees attached to the work of inspectors were small, and the inspectors, being laymen, had a natural hesitancy in meddling with matters concerning which they had little knowledge, and not always very much interest. So far as I can learn no serious efforts were made by these Boards to prevent or suppress contagious disease, and it is not surprising that glanders, being allowed to obtain a firm foot hold in one district, gradually overran the others, and assumed the aspect of a perpetual menace to the stock owning industry and plantations.

During the first three years of my residence, however, I saw no cases of the disease, and had every reason to believe that this island was free from its destructive ravages. In 1898, arriving one evening at a plantation stable, I was informed that a mule had died that day showing symptoms of glanders. Although incredulous, I exhumed the carcass and, to my surprise, found that the diagnosis was a perfectly correct one, the nasal mucous membrane being greatly inflamed and exhibiting typical glanderous ulceration. An examination of the mules in the stable revealed another animal in the earlier stages of the disease, and it was immediately destroyed. The next outbreak appeared in a stable belonging to a Chinese storekeeper, and this was followed by an extensive plantation outbreak. The problem of the origin of these outbreaks was decidedly puzzling, but I had already begun to suspect that the carriers of infection were the native bred animals belonging to the poorer class of horseowners, and this suspicion was confirmed by a visit to the Kohala district in April, 1900, where I found the disease very prevalent, and causing great damage. The disease had been noticed in this district for several years, but apparently the stock owners had acquired the erroneous impression that it was merely a form of

"epizootic," and had not taken any steps to protect themselves or their neighbours; and considering the entire absence of sanitary restrictions, it is remarkable that the loss of animals was not heavier. Nobody was able to account for the introduction of glanders into this district, except by a somewhat hypethetical and unsustained theory that it was brought in by a consignment of mules from California about the year 1895. Whilst this is very possible, it may be that the disease had never been completely eradicated in former days, and that these cases were dus to a chain of infection maintained from that time.

The following statistics of the occurrence of glanders relate only to the districts of North Hilo, South Hilo, and Puna, no authentic figures being obtainable from other parts of the island. They are necessarily incomplete because of a large ignorant population who seldom give notice of the existence of this disease among their animals, and there is no doubt that very many cases did not come under observation.

Year:	No. of outbreaks:	No. of cases:
1898	1	3
1899	2	3
1900	5	44
1901	10	27
1902	2	11
1903	4	15
1904	4	4
1905	3	3
1906		
1907	2	5
	32	114

A further analysis of these figures is instructive:

No. of outbreaks.	No. of animals in each outbreak.
*2	20
1	11
*1	10
1	6

3	5
1	4
5	2
18	1

Only seven of these outbreaks, each of a single case, were detected outside of the larger stables. The three outbreaks marked with an asterisk occurred under exceptional conditions which unfortunately cannot always be prevented, and are always liable to be encountered in a campaign against glanders. Such conditions may be produced by the co-existence of a catarrhal epidemic in the same stable; by poor stable management, unsanitary premises, animals debilitated from lack of sufficient food or over-work; and, particularly, by delay in notification, neglect or ignorance on the part of employes, and disregard of instructions. On the whole, however, when the number of exposed animals in most of these outbreaks is taken into consideration, these figures may be looked upon as satisfactory. Great assistance has been rendered by the large stock owners, and it is owing to their hearty and efficient cooperation that the disease has been restrained within reasonable limits.

I consider that four hundred animals is a fairly conservative estimate of the losses from glanders on this island during the above-mentioned period; placing an average value of $100 on each animal we may conclude that the monetary loss from this cause has been about $40,000.

My experience convinces me that the complete eradication of this disease is possible if certain essential measures are put into effect, but that this cannot be accomplished if the present system is continued. The measures that appear to be necessary are:

(1) A systematic campaign of education.
(2) Effective cooperation on the part of the more intelligent horse-owning public.
(3) A system of local veterinary inspection that will cover the whole island.

(4) Periodical inspection of the horse stock in each district.

For the benefit of individual plantations we may remark that, (a), glanders is a purely contagious disease and never originates spontaneously, or from a pre-existing disease; (b), infection of large stables is almost invariably caused by contact with "scrub" animals belonging to stage-drivers, store-keepers, small contractors, laborers, etc.; and (c), the majority of plantation outbreaks appear primarily in the smaller, outlying stables, where supervision is less strict, and little effort at segregation of plantation animals is made. The following recommendations, based upon these facts, are suggested:

(1) Plantation animals should be protected as far as possible from contact with outside stock. The most immediate points of contact are (a) the stable, (b) the pasture, (c) the watering-trough.

(a) Plantation stables should be reserved for plantation animals. Exception should only be made in favor of animals coming from stables with a known and clean record.

(b) No outside animals should be allowed in private or plantation pastures. Where pastures run along public highways there should be an inside fence 15 feet from the road.

(c) The plantation watering-trough should not be allowed to be a public convenience.

(2) Exercise care in the purchase of native horses, and do not allow overseers to introduce cheap "scrub" animals into stables unless satisfied that they are in good health.

(3) Quarantine immediately any horse or mule showing any symptoms that suggest the slightest suspicion of glanders.

(4) For this purpose each plantation should possess at least one suitable quarantine stable. This should be situated at least 500 feet from the nearest stable, and constructed as follows: One, or more, 10x10 feet box-stalls; board floor with tarred seams, or

concrete floor; walls slatted on the outside; window-openings 6½ feet above floor; all openings to be made fly-proof. (It is my experience that these quarantine stables are an absolute necessity on the plantation. I have seen nineteen plough mules sacrificed on one plantation for want of this comparatively inexpensive procaution. The fly-proof stall is advisable because there is reason to believe that mechanical transmission of glanders through the medium of flies occurs in this country.)

(5) When glanders is evident, or there is reasonable suspicion to warrant it, notify the nearest veterinary inspector at once.

(6) In dealing with animals suspected of this disease the stable attendants should be warned of its transmissibility to human beings, and particularly directed not to unnecessarily handle such animals, and to wear boots around the stables.

In addition to these recommendations it is desirable, where it is practicable, that the outside stock be periodically examined by a veterinary inspector at intervals of not over six months.

EPIZOOTIC LARYNGITIS (Sore Throat) IN HORSES.

Introduction. By laryngitis is understood an inflammatory or catarrhal condition of the mucous membrane of the larynx (the upper end of the wind pipe). The simple form of the disease is common among horses and dogs and is produced by the same conditions as those which are responsible for sore throat and cold in the head in man.

On the mainland the disease is very prevalent during spring and autumn when the animals are exposed to sudden climatic changes, but may occur at any time of the year as the result of negligence with animals overheated from work or exercise.

As sudden climatic changes are very rare here and as there is no decided cold season, sporadic cases of acute laryngitis are not so common. It is therefore rather remarkable that a disease, in most respects identical with acute laryngeal catarrh

or laryngitis, should break out here in epidemic form. Such was, however, the case in 1906 when a severe outbreak of epizootic laryngitis occurred in Honolulu and during the following year spread to many other places in the Territory. That the disease was highly contagious, and not due to or perceptibly influenced by climatic conditions cannot be doubted, as, when once introduced into a stable, it spread, sometimes in the course of 24 to 48 hours, to practically every animal on the premises. This was observed, in some instances, in large plantation and livery stables.

In Honolulu a great number of horses were, as stated, attacked, one practicing veterinarian making over five hundred calls in one month to attend to animals affected with this disease alone. Most of the sick animals made a good recovery under proper treatment and with ordinary care, and only constitutionally weak animals, or such as were continued at work after they became affected, developed such complications as intestinal disorders and pneumonia or pleurisy, which in some cases resulted in death.

Later the disease even spread to the ranches, where it proved severe on animals which were left on the range during cold and rainy weather, and a number of deaths occurred, either from pneumonia or from glottis oedema (acute watery swelling of the mucous membrane of the upper part of the larynx, causing partial or complete obstruction of the air passages).

Symptoms. The disease in most cases affects the animals without any perceptible premonitory symptoms. Where these are present they manifest themselves by slight fever, impaired appetite and lack of energy. Most frequently the first indication of any sickness is the hard, dry cough, as a rule not very painful, but often rather persistent. A slight pasty swelling develops between the branches of the lower jaw and there is marked tenderness to pressure on the larynx and upper part of the trachea, such pressure often bringing on a severe spell of coughing.

At the outset there is but a very slight watery discharge from the nostrils and in some cases the conjunctiva of the eye is inflamed, the lids somewhat swollen, with slight discharge of tears.

In the course of a few days the inflammation of the mucous membrane of the larynx subsides, and the hard, racking cough becomes soft and mucous. The discharge from the nose becomes serous, then purulent, and may be very abundant, while the constitutional symptoms gradually disappear.

Course and Termination. In by far the greater majority of cases the course of the disease requires only from eight to fourteen days, before the patient is convalescing. As soon as the inflammatory stage is passed and the cough has become soft there is little danger of complications and the further treatment is purely dietetic. If the tenderness around the larynx subsides without any apparent improvement, it is an indication that the disease has extended further down and an examination of the chest will reveal the true conditions. This, however, rarely occurs except in animals which have been continued at hard work or not protected from inclement weather and repeated attacks of cold. In the latter case the disease may terminate suddenly as the result of oedema of the glottis. This generally occurs at night and the following morning the horse is found dead with blood-colored froth running from the nostrils. The condition is fully described by Prof. Law, who says that "if exudation delays, the symptoms may become more intense, and breathing may get loud and difficult in connection with thickening and rigidity of the mucous membrane, or a serous exudation into it and beneath it (oedema glottidis) which by closing the glottis renders breathing almost impossible. The same distressing symptoms may arise from spasm of the larynx excited by the inflammatory action. As arising from thickening or infiltration of the membrane, these symptoms may come on comparatively slowly, but in the case of spasm they appear suddenly and have periods of intermission, reappearing on suc-

ceeding days and usually at the earlier part of the night. In such circumstances the loud, noisy breathing is heard at a considerable distance, the horse stands obstinately still, the fore feet apart, the elbows turned out to allow a freer action of the chest, the flanks working laboriously, the head low, the nose protruded, the nostrils widely dilated, the mouth open, the eyes standing out from their sockets, red and wild looking, and the face constrained and pinched, the whole expression being that of intense agony from impending suffocation."

Treatment. The most important measure when an animal becomes affected with laryngitis, and especially if the weather is unfavorable, is not to use it for work of any kind, but to allow it to rest in a roomy, well-ventilated stable, protected from drafts and lightly blanketed. A mustard poultice, or in lighter cases a camphor and turpentine liniment, should be applied to the throat, after which a piece of sheep skin (with wool turned in), or a strip of woolen blanket, should be tied around the throat and well up toward the ears. In more severe cases a folded towel should be wrung out of a bucket of cold water and folded around the throat, covered with a waterproof sheet, around which the sheep skin or woolen blanket is applied (Priessnitz poultice). The waterproof sheet prevents evaporation and the pack should not be changed frequently, but left on for three to six hours, when it may be removed or repeated according to conditions, and followed up by the mustard poultice or liniment as above referred to.

The inflamed mucous membrane of the larynx may be relieved also by inhalation of vapors which will stimulate the mucous secretion. This is done in the following manner. Place one gallon of water in a bucket and add two ounces of creolin or similar creosote disinfectant. Thoroughly heat a brick or flat stone in a fire, place in the bucket and allow the animal to inhale the vapors. This is facilitated by placing the bucket in a sack which then is folded around the nose of the animal. The use of the sack obviates the necessity of having the nose of the

animal close to the bucket and insures that the animal gets the full benefit of the steam even when the treatment is undertaken in the open air. As the cough is always most severe towards evening and during the night, the steaming should be done just before the animal is left for the night. In severe cases this treatment may be repeated several times every day and should be continued until relief is obtained.

The diet is of great importance in this disease. Hay and grain should be dropped out entirely and hot bran mashes with a tablespoonful of common salt substituted. Freshly cut green grass is the best feed when it can be obtained. A pail full of fresh cool water to which has been added two drams of chlorate of potash to each gallon of water, should be before the animals all the time.

This treatment will suffice in a great majority of cases, and aggravated cases are, as a rule, due to negligence of the precautions here given. For further medicinal treatment the readers are referred to the "Special Report on Diseases of the Horses,"[1] issued by the United States Bureau of Animal Industry and which is presumed to be in the possession of every horse owner.

[1]U. S Dept. of Agr, Bureau of An. In., Special Report on Diseases of the Horse, revised edition 1907, pp. 112-116.

To obtain this volume application accompanied by P. O. money order for sixty cents must be made to the Superintendent of Documents, Government Printing Office, Washington, D. C., to whom the remittance must be directed. The same applies to the Special Report on Diseases of Cattle.

EYE DISEASE IN CATTLE.

Synonyms: acute infectious conjunctivitis, acute infectious keratitis, infectious ophthalmia in cattle, distemper of the eye.

Introduction. This eye disease generally appears in an enzootic or epizootic form and affects quite a number of animals in the herd. It is most common among the ruminants, especially cattle, but sheep, goats and horses have been known to become infected.

It is distinctly a contagious disease and may be brought into a previously healthy herd by one animal with sore eyes. It may continue in a herd for a season or for several years, affecting all newly purchased animals.

The native cattle in this Territory seem to possess a considerable degree of resistance, for the disease principally attacks imported animals and to a certain extent their offspring, while it is comparatively rare among the common stock.

It affects both young and old animals and in some outbreaks confines itself almost exclusively to the calves.

In the States the disease is seen exclusively in the summer months and never during the cold weather, while in this Territory it may occur at any time of the year.

Symptoms and Course. The disease manifests itself as an irritation of the eye with photophobia (exaggerated sensitiveness to light) and a copious discharge of tears. The conjunctiva (the mucous membrane of the eye) and the eye-lids become swollen and red and the eyes are kept continually closed.

As the disease progresses, the discharge of tears become purulent on account of the admixture of pus, and forms a broad streak down the face, in which dust and dirt settles and which is very characteristic in Hereford cattle on account of the white face.

Hereford cattle seem to be more susceptible to the disease than animals with colored eye-lids and face, but this impression is undoubtedly due to the fact that the symptoms manifest themselves more strongly on the unpigmented skin.

From the conjunctiva the inflammation spreads to the cornea (the transparent part of the eye ball), which assumes an opaque, milky appearance, causing temporary blindness in the affected eye.

Unless proper treatment intervenes the milky appearance changes to a reddish or brownish color, due to exudation into and vascularization of the cornea in the center of which a small grayish yellow spot appears, which often is mistaken for a for-

eign body. By close observation, however, it is seen to consist of an oblong or oval swelling, about the size of a grain of barley, and with a rough surface, and is due to an abscess in the cornea. This abscess ruptures in the course of a day or two, the contents are discharged and the cavity becomes filled with granulations. The opacity of the eye becomes less intent, the inflammation gradually subsides, and in the course of two to three weeks the surface of the cornea has become smooth and shows only a small white scar in the center, which in most cases disappears completely.

In unfavorable cases the abscess on the cornea may open into the anterior eye chamber, generally resulting in the loss of the eye, or the ulcer on the surface may spread superficially upon the cornea, resulting in permanent opacity.

As a rule only one eye is affected at a time and when this is nearly recovered the other eye becomes infected. In the same way only a limited number of animals in a herd may be simultaneously affected, new cases appearing at intervals of days or even weeks.

As failure to administer proper treatment frequently results in the loss of one or both eyes it will be seen that an outbreak of this disease may be a very serious matter, especially so far as imported breeding stock is concerned. In one case the introduction of the disease with an importation of 40 pure-bred bulls required nearly six months for its suppression, even though every precaution was taken to prevent the spread of the disease from animal to animal.

The disease assumes in various countries a more or less severe form, and from observations made in this Territory there can be little doubt that unless careful and continued treatment is administered, a great number of the affected animals would loose their sight permanently.

On the Texas cattle ranges the disease is common and as a rule assumes a very mild form, and, when taken in time, one treatment is generally sufficient to cause recovery.

With proper treatment from two to four weeks are generally required here for complete recovery, but frequently the animals have to be confined and treated every day during the beginning of the disease and every two or three days during the period of convalescence.

European investigators report as high as eighty per cent. of permanent blindness or total loss of the eye as resulting from this disease.

Treatment. As the disease is of an infectious nature, it is advisable to segregate the affected animals without delay. The infection is, however, known to have been carried by wind and dust for distances of several miles, and the question may arise, especially when the disease appears in a mild form, whether it would not be more economic to allow all of the susceptible animals in the infected herd to contract the disease as soon as possible, instead of having the outbreak extend over months. If the disease is of a more malignant nature such a course will not be advisable.

When an outbreak makes its appearance among valuable stock the following remedies may be required:

(1) Absorbent cotton in two-ounce packages, or a couple of small soft sponges which, however, must be sterilized by boiling every time they are used.

(2) One dozen medicine droppers with rubber bulbs, half of them straight and the other half with curved nozzle. The straight droppers are used to force medicine in between the closed eye-lids. This is done by slightly parting the lids by means of the index finger and thumb of the left hand. The nozzle is then inserted parallel with the surface of the eye, and the lids allowed to close over it. The bulb is then squeezed and the medicine forced in. The curved droppers are used when it is desired to apply medicine direct to the surface of the cornea, when the eye-lids are being kept open with the left hand.

(3) Six ounces of boracic acid for washing and cleansing the affected eye and the surrounding tissues. Place one ounce

of boracic acid in a one-quart bottle and fill the same with warm water. Shake until dissolved.

(4) Four ounces of iodoform ointment, one part iodoform to eleven parts of pure vaseline. In preparing this ointment the iodoform should be thoroughly ground in the mortar with approximately the same volume of vaseline, until all small particles have disappeared, after which the remaining vaseline is added and worked until the ointment is smooth and homogeneous. If carelessly prepared the undissolved iodoform particles may have an irritating effect.

(5) Six ounces of an astringent and anaesthetic solution according to the following prescription: Silver nitrate 18 grains, morphine sulphate 6 grains, distilled water 6 ounces.

(6) Three ounces of a powder, consisting of calomel 1 ounce and powdered white sugar 2 ounces, mixed.

The treatment consists in thoroughly cleansing the eye-lids and surrounding parts with castile soap and warm water and rinsing with the boracic acid solution. The latter is also supplied by means of the straight medicine dropper to the inside of the eye-lids or with the curved dropper to the eye-ball itself.

If the disease has only reached the state of inflammation of the conjunctiva, with swelling of the eye-lids and a faint cloudiness of the cornea, an application of the iodoform ointment is indicated. This is done by taking a lump of the ointment the size of a coffee bean, by means of a small flat stick with smooth rounded edges, and applying the same to the inside of the lower eye-lid, which is pressed down by the thumb of the left hand. When the ointment is inserted the eye is allowed to close and the outside of the eye-lids is then gently massaged, in order to make the medicine spread over the inside of the eye-lids and the surface of the eye-ball.

This treatment will in many cases interrupt the further development of the disease, and may, if considered necessary, be repeated every day or every two or three days. The ointment acts both as an antiseptic and as an anodyne, and its effect is

more lasting than the application of fluid remedies. This treatment is in fact the one most commonly adopted on the mainland and has given general satisfaction on account of the ease with which it can be applied. In localities where the disease is common the cowboys carry a small box of the ointment in their saddle bags and affected animals observed on the range are caught and doctored on the spot.

In the case of high-priced breeding stock it is advisable to place the animals in a cool, dark stable, as the treatment seems to have much better effect when the eyes are not exposed to the strong light of the sun. In any case the affected animals should have access to shady retreats.

In the case of animals which are easily handled and which are kept in stable or in a convenient yard with chute, the nitrate of silver and morphia solution may be used instead of the ointment, but should be applied at least three times a day.

When an ulcer has formed on the cornea the calomel and sugar powder should be used. This is done by making a small tube out of an ordinary piece of letter paper, the one opening being about a quarter of an inch and the other about three-quarters of an inch in diameter. By means of the latter end a small amount of the powder is scooped out of the box and by shaking distributed along the inside of the tube. The eye is then opened and the powder blown on the surface of the eye.

When the ulcer shows tendency to fill up with granulations protruding above the surface of the cornea and the wound shows a sluggish disposition the best treatment is the use of solid nitrate of silver. A stick of this is scraped to a point, the animal's head is secured, the eye-lids parted, and the ulcer lightly touched with the silver. After waiting a few minutes the eye is thoroughly washed out with pure water which has previously been boiled and to which has been added a pinch of table-salt. If, after this treatment, the ulcer assumes a delicate fleshy tint and the redness around it disappears, it is not necessary to repeat the operation, but the treatment with the nitrate of silver

and morphia solution may be continued. If not, it may be necessary to use the nitrate of silver stick again three or four days after the first application.

In case the interior chamber of the eye should become ruptured, there is nothing to do but to try to prevent the complete loss of the eye by irrigation with boracic acid solution followed by the nitrate of silver and morphia solution.

ENZOOTIC STOMATITIS IN HORSES.

Synonyms: Mouth disease, Catarrhal inflammation of the mouth, Aphthous stomatitis, Ulcerative stomatitis.

Introduction. This disease consists in its most simple form of inflammation of the mucous membrane of the mouth, tongue, and lips and may be produced by irritating medicines or foods or may be of microbean origin, such as the moulds affecting hay and grain. When due to mechanical or chemical irritation one, or only a few cases may be seen in a stable or paddock, but when of microbean origin a greater or less number of horses may become affected at the same time and the disease assumes an enzootic nature.

This was the case with an outbreak of pustulous stomatitis among the horses on a ranch on Maui where I was called during the beginning of 1907.

The manager of the ranch had noticed that a great number of the animals in his horse paddock were slobbering from the mouth, unable to eat, and falling off in condition very rapidly, some of them to such an extent that in the course of a few days they were too weak to move. He naturally became alarmed and appealed to the Board for assistance. In the meantime he rounded up all of his horse stock and segregated the affected ones, holding the rest for inspection.

It was seen at a glance that the disease was a rather aggravated form of pustulous stomatitis and the manager was assured that there was no cause for alarm, if proper care could be taken of the affected animals.

Symptoms. Professor James Law gives the following description of the disease:

At the outset and in the slighter form of congestion there is merely heat and dryness of the mucous membranes of the mouth. Redness may show on the thinner and more delicate portions of the membrane, but elsewhere it is hidden by the thickness of the membrane.

As the congestion is increased there is seen a slight tumefaction of the mucosa, especially of the gums and lips and under the tongue. The mouth is very hot and tender to the touch. The surface layers of epithelium degenerate and form with the mucus a sticky, gummy film which, mingling with decomposing alimentary matters, gives out a heavy offensive or even fetid odor. Mastication becomes slow and painful and morsels of food are frequently hidden in the mouth, where they aggravate the local conditions of the decomposition.

The dry stage is followed by a period of hypersecretion in which the salivary glands take a prominent part, so that slobbering becomes a most marked feature of the disease. The saliva mixed with the increasing secretion of mucus escapes from the lips and hangs in a stringy mass from the mouth. When there is much motion of the jaws and tongue it accumulates as a froth around the lips.

A careful examination of the mucous membrane shows small conical elevations, surrounded by a deeper zone, representing the tumefied openings of the obstructed mucous follicles and later these may show as small erosions or even as vesicles.

In the outbreak on Maui these erosions and vesicles were common, and were noticed even on the outside of the lips and on the chin.

Cause. As the most common cause for this disease Prof. Law mentions fungi in fodder, rust of wheat, blight, ergot, and moulds; watery vegetation (honahona or Wandering Jew) is liable to cause stomatitis.

Red and white clover, trefoil, hybrid and purple clover, and alfalfa have all acted more or less in this way, though in many cases the foods have become musty or attacked by bacterial ferments.

In Germany, where the disease is common, one of the principal causes is given as the hairy caterpillar, the hairs of which are said to contain an acrid substance which, when introduced into the mucous membrane, causes inflammation.

That these caterpillars may have been the cause of the outbreak on Maui is possible, though the manager stated that he had not noticed them to be present to a greater extent than usual at that time of the year.

Treatment. The treatment is simple and consists in the removal of the irritant cause and the soothing of the irritation. In this direction a careful selection of diet is the most important thing. The affected animals should have access to fresh cool water so that they may rinse out their mouth at will. Hard straw, coarse hay and grain should be withheld, and their place taken by tender grass, bran mashes or gruel.

Medical treatment may be given in the drinking water in the form of chlorate of potash, not to exceed one half of one ounce per day according to the size of the animal. In severe cases the mouth may be syringed out with an antiseptic or astringent solution, such as permanganate of potash, creolin, common salt or borax.

This disease is always very amenable to treatment and complications rarely arise.

LEAD POISONING (Plumbism) IN CATTLE.

Sources. This fatal disease is comparatively rare and occurs principally in the vicinity of lead mines and smelting furnaces, where the lead is deposited from the air in a fine powder and consumed with the vegetation.[1] This source of poisoning is common in England but it is of course out of the question in this Territory.

[1] James Law Veterinary Medicine, Vol. 3, p. 141.

Another source is the lead paints used about farms, such as white lead (oxide of lead) which is used here in tightening the joints of water pipes, at least where the same are being laid from reservoirs to stock watering troughs.

Unfortunately most of the lead compounds have a sweet taste, which in connection with the morbid habit in cattle, which is very pronounced in certain districts of these Islands, of eating undigestible and non-alimentary substances, make it a serious matter to use lead in any form where cattle can get at it.[2]

[2] Ibid. p. 142.

A case of this nature, and which resulted in serious losses, was observed on a ranch in this Territory, and will serve as a warning for stock raisers and others who are contemplating the laying of pipe lines or the use of lead compounds in any form.

Lead poisoning in the Territory. On July 23d, 1907, I was called to a certain ranch and upon arrival received the following information: Seventeen cows and two calves had died in the course of a few days out of a bunch of 75 or 80 head. The animals, all pure bred Herefords, some of them imported stock, consisted of about 50 cows, some two-year-olds and yearlings, and the rest calves. Most of them were excessively fat and had been moved some time previously from a fattening paddock on the mountains to a small paddock near the home ranch, in order to reduce their condition. They had been in the said small paddock for about a month when the first death occurred on July 16th. The following day three died, and the day after (18th) eight more. That day the animals were moved into another paddock, some of the last eight dying in the first paddock, some on the way and some in the new paddock. On the 19th one more died and the animals were moved into a third paddock where three more died. Some of the dead animals had been cut open for examination without anything definite being found, except that one cow showed red spots in the third stomach, apparently caused by some irritant. All of the other organs seemed to be

perfectly normal, and the carcasses in fine condition as to flesh and color.

Twice before in previous years the same breeding herd had been brought down to the same paddock without loss, and another lot of cows and calves from similar country and also excessively fat had been brought down and placed in this paddock on January 25th and remained there to about May 1st without any loss. The feed in the paddock was good and the weather had been favorable up to the time of my arrival. Two outside cattle had died alongside the paddock fence and poisoning was naturally suspected.

After learning these particulars an examination of the remaining animals was made. They were in a paddock about three miles from the original paddock, and were to all intents and purposes as fine and healthy a lot as could be wished for. In order to determine if any of them were at all affected they were moved around in a bunch for an hour, but none of them lagged behind or showed any symptoms of distress. In moving the herd a few days before it had been noticed that the ones which afterwards died, soon got out of wind, began to tremble and refused to move any further. An attempt at a post-mortem examination was made with a couple of the freshest carcasses, but they were too decomposed and discolored to furnish any clue to the cause of death. A careful examination of the paddock likewise failed to reveal anything of a suspicious nature as far as grasses, weeds or water were concerned. A cowboy was left to watch the animals with instructions to report immediately any new case which might develop, and the second paddock in which the animals had been kept for one day was examined with similar result.

By the time the original or first paddock was reached there seemed little hope of solving the problem, especially in view of the fact that the animals had continued to die after they were removed from it. In this paddock, however, the clue to the problem was found.

In riding around it with one of the employees of the ranch and discussing the various poisons as possible causes of the many deaths, eliminating each in turn as its effect on cattle was compared with the facts in hand, we practically stumbled over the actual cause in the form of a new pipe line which had just been laid through the paddock and a short distance beyond it, the work having gone on while the animals in question were there.

Red lead had been used in abundance at every joint, twenty-feet apart, having been applied to the pipe for a couple of inches in each direction from the collar of the joint. There was red lead on the grass at every joint where the paint can had been deposited. The empty can was presently found and judging from the inside appearance, which showed the bottom and sides perfectly clean and polished with only dry paint left in the corners, and this marked by the rough tongues of the cattle, there could be little doubt that the animals had been licking the paint.

The examination of those who had seen the affected animals before death now took a more definite form, as long forgotten textbook knowledge was recollected, the writer never before having seen a case of lead poisoning in cattle, even though it was eighteen years since he took his veterinary degree. The muscular tremors, the profuse salivation and the constipated bowels were recollected and confirmed. Finally the foreman of the pipe layers was sent for and he stated that he had great difficulty in keeping the animals from licking the paint off the pipes and to keep them away from the can. He had also seen several animals with paint on their noses.

What doubt remained as to the diagnosis was dispelled the following day, when it was reported that a new case had developed. This proved to be a beautiful two-year-old heifer in prime condition. It was found close to the fence of the paddock, separate from the rest of the bunch which was grazing together a considerable distance away. The heifer was standing up, with the back arched and the head toward the ground, saliva

and masticated grass running from the mouth. Muscular tremors of the neck and shoulders, at times so violent as to throw the animal off its forefeet while it would remain standing on the hind feet. In this position, with its fore knees on the ground and standing up behind it would remain as long as the tremors lasted, at times for half an hour. The coat was rough and the eyes had an anxious and sometimes wild expression. The pulse was hard and threadlike, but not accelerated. Temperature subnormal, bowels constipated.

As a cold rain had set in the animal was loaded on a wagon and taken to the ranch stable. Here it was bedded down and covered up warmly.

The treatment consisted in 20 grams of iodide of potash in a pint of warm water, followed at intervals of three hours with one-half pound doses of Epsom Salts (sulphate of magnesia). The animal seemed for a while to improve, and was standing on its feet when left for the night. The next morning, however, it was found in a stupor and died at three o'clock that afternoon, thirty hours after it was found sick. The bowels had moved several times during the night and water had been passed.

On post-mortem examination only slight indications of gastroenteritis were found. One of the kidneys and the bladder were placed in a jar and sent to Honolulu where they were submitted to the chemist of the Territorial Board of Health for analysis. A few days later the following letter was received:—

"I beg to report in regard to examination for poisoning of lead in urine and kidney submitted July 27, 1907, that no lead was detected in the urine but a small amount was found to be present in the kidney. The quantity present was not sufficient for a quantitative determination."

(Signed) R. A. DUNCAN,
Food Commissioner and Analyst.

When this heifer was found exhibiting typical symptoms of lead poisoning on the fourth day after it had been removed from the only possible source of poisoning, much apprehension

was naturally felt as to how many more might have lead in their stomachs and subsequently might develop symptoms of acute poisoning. It was, therefore, decided to immediately take such measures to render the poison innocuous, as were possible under the circumstances. The entire bunch was rounded up without delay and taken back to ranch headquarters where they were placed in a corral with a chute arranged for the doctoring of stock.

Fortunately a sufficient amount of iodide of potash was at hand to furnish a large dose for each of the remaining animals. The large cows were given 20 grams each, two-year-olds 15 grams, yearlings 10 grams and calves 5 grams. After that no more cases developed.

Physiological Action of Lead and Lead Compounds. The physiological action of lead is exerted on the nervous system. Only the soluble lead salts, such as acetate of lead (sugar of lead) are violent irritant poisons, producing burning in the oesophugus and stomach, followed by vomiting and either purging or constipation.

The metal itself and the insoluble preparations are incapable of acting as acute irritant poisons, but produce sub-acute and chronic lead poisoning.[1]

1 U. S. Dispensatory, 19th edit., p. 977.

The latter forms are most commonly met with in ruminants, the metal or its compounds remaining in the first three stomachs for a considerable time. Here they are gradually dissolved or changed into soluble salts by the acids of the stomachs, in which form they enter the circulation and finally become deposited in the nerve cells of various organs and tissues, causing nervous disturbances such as muscular tremors, convulsions and, in the more chronic cases, paralysis of the extensor muscles, especially those of the forearm. (Note that the heifer above described remained kneeling on the fore-knees as a result of such paralysis.) The function of the digestive organs and the kidneys are suppressed, whereby the elimination of the poison from the system is retarded.

Treatment. According to Prof. Law the first object in the treatment is to prevent the further soultion of lead in the alimentary tract and to carry it off. To effect this a purgative such as sulphate of magnesia (Epsom salts) or sulphate of soda (Glauber's salts) should be preferred as favoring at once elimination and the formation of an insoluble precipitate,—sulphate of lead. Epsom salts is preferable on account of its quicker action and large doses (1 to 2 lbs. for grown cattle) are desirable because of the bulky contents of the stomach and the torpor of the alimentary canal.

To assist in the elimination of lead which has passed into the circulation or become deposited in the tissues, the administration of potassium iodide will serve, as it transforms the lead into a soluble form which is discharged through the bowels and kidneys. The bowels should at the same time be kept relaxed by repeated small doses of salts.

INSECT PESTS OF LIVE STOCK.

In conjunction with Mr. D. L. Van Dine, Entomologist of the Hawaii Agricultural Experiment Station, the writer has undertaken to make a complete survey of the insects affecting live stock directly or indirectly in this Territory.

As this undertaking will require the investigations of numerous species of insects about which very little is known at the present time, as well as numerous laboratory and field experiments it is probable that the work will extend over several years. The writers have, therefore, decided to publish from time to time such observations and conclusions as may be deemed of interest to the live stock raisers of the Territory.

The first paper on this subject was published quite recently in the proceedings of the Fifth Annual Meeting of the Hawaiian Livestock Breeders' Association under the title of "Abstracts of the Preliminary Report of Insects Affecting Live Stock in Hawaii." As this report will reach only the members of the said Association, it has been deemed advisable to quote in this

report the chapters on the Horn-fly, the Warble-fly and the Hawaiian Sheep Maggot-fly, on account of the great economic losses caused by these insects either here or on the mainland of the United States.

The writers have estimated the losses of live stock in the Territory during the past year at between $60,000.00 and $75,000.00 and have come to the conclusion that the prevalence of insects pests in the Territory is due, in a great extent, to the almost total absence of insectivorous birds as well as that of scavenger birds and mammals.

The fact that an entirely new and practically obscure species of Maggot-fly which has hitherto been supposed to infest only dead animal tissues, has suddenly become parasitic to living animals, thereby causing the losses of great numbers of sheep, is a very interesting and important subject which has been discussed at length and the writers request that observations, opinions, and suggestions pertaining to the prevalence of insect pests and their suppression be forwarded to them together with specimens of the species referred to in each case.

The Horn-Fly.
(*Haematobia serrata Desvoidy.*)

The horn-fly was introduced into Hawaii in shipments of cattle from the western coast of the United States to the island of Oahu during 1897 and within the following year spread to all the other islands.[1] For ten years this pest has bred uninterruptedly and the worry and irritation from its blood sucking habit has been felt during this time by the thousands of cattle on Hawaiian ranches. The smaller dairy herds likewise have suffered injury. Horses are bothered to some extent by the horn-fly, the irritation being especially noticed on cow-ponies when working cattle. Recently Norgaard has pointed out the complication of sheep-scab and horn-fly injury on sheep.[2] To this complication has later been added that of the maggot-fly, which in many cases take up the work of destruction in con-

nection with, or subsequent to, the injuries caused by the scab and horn-fly parasites.

[1] A. Koebele. Rept. of the Entomologist. Rept. of the Minister of the Interior, Republic of Hawaii, 1898, Honolulu, 1899, pp. 84-87.
[2] Rept. of the Div. of Animal Industry. Rept. Bd. Comms. Agri & Forestry, Hawaii, 2 (1905), pp. 171, 211, 212.

History of Introduction. This insect, of European origin, was introduced into the eastern United States on imported cattle not earlier than 1885 and possibly as late as the spring of 1887. By 1889 the pest had spread throughout the eastern United States and in 1891 it is recorded from Canada to Texas and from Massachusetts to the Rocky Mountains.

General Characteristics and Habits. The following summary of the horn-fly is taken from Bulletin No. 5, U. S. Bureau of Entomology.

That the loss from their presence is very considerable is recognized by most practical stock breeders who have every day association with the affected animals, the loss showing in reduced vitality, lack of growth, or in loss of milk.

Mr. Fletcher, the entomologist of the Dominion of Canada, estimated the loss in Ontario and Quebec at one-half the product.

The loss is the direct result of the irritation to cattle, which keeps them in a perpetual worry and interferes with their feeding and with the normal digestion of food, and to some extent, from the loss of blood which, when the flies occur by the thousands on a single animal, is an item not to be ignored.

Injury to other animals than cattle seems to be very slight, and while a number of records have been given of the insect occurring upon horses, these seem to be exceptional.

The flies are observed in greatest numbers in July, but appear as early as May, and remain till cold weather, the full time depending upon the season or latitude.

The characteristic habit of clustering about the base of the horn seems to exist only when the flies are quite abundant. When they average only a hundred or so to a single animal,

comparatively few will be found on the horns. Moreover, as a general thing the horn-clustering habit seems to be more predominant earlier in the season than later, although the flies may seem to be nearly as numerous. Careful study of the insects in the field shows that they assume two characteristic positions, one while feeding and the other while resting. It is the resting position in which they are always found when upon the horns. In this position the wings are held nearly flat down the back, over-lapping at base and diverging only moderately at tip. The beak is held in a nearly horizontal position and the legs are not widely spread. In the active sucking position, however, the wings are slightly elevated and are held out from the body, not at right angles, but approaching it, approximately an angle of 60° from the abdomen. The legs are spread out widely; and the beak, inserted beneath the skin of the animal is held in nearly a perpendicular position.

The fly before inserting its beak has worked its way through close to the skin. While feeding, however, the hairs which can be seen over its body do not seem to interfere with its speedy flight when alarmed, for at a fling of the tail or an impatient turn of the head the flies instantly rise in a cloud of a foot or two, returning again as quickly and resuming their former positions.

The horns are not their only resting places, for with the horns black for two inches above their base, we have seen the flies toward nightfall, settle in vast numbers upon the back and between the head and foreshoulders, where they can be reached by neither tail or head. When feeding, they are found over the back and flanks and on the legs. During a rain storm they flock beneath the belly. When the animal is lying down a favorite place of attack seems to be under the thigh and back belly, around the bag. With certain animals the dewlap seems to be badly attacked, while with others this portion of the body is about exempt. Certain cattle, again, will be covered with flies and will lose condition rapidly, while others are troubled but slightly.

On the horns the flies settle thickly near the base often forming a complete band for a distance of two inches or more. They seem to prefer the concave side to the convex side of the curve of the horn, probably for the reason that the cow can not scrape them off so readily, and one cow was noticed in which they reached nearly to the tip of the horn on the concave side of the curve only.

The time and method of the deposition of the eggs were for sometime a puzzle, but it was clearly shown in the investigations of the Division of Entomology that the eggs are placed in fresh cow manure in daytime, mostly between 9 a. m. and 4 p. m. and that in laying them the female darts only for an instant from the cattle, immediately after the dung is passed, and that within a little more than a minute afterward all had returned to the animal. They are laid singly, and never in clusters, and usually on their sides on the surface of the wet dung; seldom inserted in cracks.

After the eggs hatch, the larvae descend into the dung, remaining, however, rather near the surface.

The larval stages are passed in from four to six days.

When ready to transform, the larvae evidently descend from the dung into the ground below from a half to three-quarters of an inch. Actual observations were made on larvae in dung in breeding cages where the soil was fine sand, affording ready entrance to the larvae. Where the dung has been dropped upon hard ground, the probabilities are that they will not enter so deeply, and may indeed transform upon the surface of the ground at the bottom of the dung.

The pupa stage may last from five to eight or ten days, so that the full time from egg deposition varies from ten to seventeen days, estimated for the average, as about two weeks. As the flies doubtless begin egg laying soon after issuing from the pupa stage, there is room for a number of generations during even a northern summer, probably from six to eight being common.[1]

1 Osborn. Insects Affecting Domestic Animals, U. S. Dept. of Agr. Bu. of Entomology, Bul. No. 5, 1896, pp. 116-120

The Horn-fly in Hawaii. From the above and from subsequent remarks it will be seen, that while the horn-fly in the United States and Canada causes more or less loss to the live stock and dairy industries, these places are favored by two distinct seasons, a cold and wet and a hot and dry season. As it requires warm and wet weather for the continual development of generations of horn-flies, it would seem that the Hawaiian Islands offer an especially favorable breeding ground for this pest. Being solely dependent upon the rainfall, and requiring but little of that, the horn-fly finds here an equable temperature, varying but slightly with the seasons and at no time detrimental to its propagation. Prolonged drouths will check it and ordinary dry weather simply retard it, but climatic conditions which might be called destructive to it rarely occur here.

It is therefore little wonder that, once introduced here, it required but a short time to spread all over the Territory and to multiply to such an extent as to compare favorably in abundance with the worst infested sections of the Mainland.

There is therefore every reason why the scientists of this Territory should give their time and energies to the problem of measures for the suppression of this menace to the only animal food product, beef, which is now supplied by the Territory without importation from the outside.

PREVENTIVE AND CURATIVE MEASURES.

The two lines of control that are offered for the horn-fly are, as with all insect pests, preventive and curative measures. Prevention implies the destruction of the larvae in the cattle dung by direct measures or by the introduction of natural enemies that will feed upon them. Curative measures imply protection to the cattle from the attack of the fly or the wholesale destruction of the adult flies. All of these methods of control have received serious consideraton, as is testified by the many reports dealing with the treatment of cow-dung to destroy the breeding place of the larvae, the introductions of natural ene-

mies from one country to another, the spraying of cattle with repellant mixtures and the trapping and dipping experiments to destroy the adult fly. These various methods and a discussion of their application to Hawaiian conditions cannot be treated in a report of a general character. The use of repellants, however, does not appear feasible in Hawaii except in the case of our dairy herds, and even here they should be used only in conjunction with preventive measures for the destruction of the larvae in the dung. Prevention, therefore, is the key-note to the control of the horn-fly.

Natural Enemies. The immense areas comprising our cattle ranges and the semi-wild condition of our herds, give emphasis to the idea that the only hope of permanent relief for the beef cattle lies in procuring effective natural enemis. The serious menace that faces cattle raising so long as the horn-fly ravages remain unchecked, justifies the continuation of efforts to procure such enemies from abroad and to establish and encourage the development of promising species already within the Territory. This phase of the control work should, however, not detract the stockmen from doing their share towards the suppression of the pest, as the natural enemy side of the control work does not become a factor until the enemy is obtained, established and its value demonstrated. In other words, while supporting morally and financially the investigations relating to this work, the ranchers should not allow the possibility of direct measures of control to pass from their mind. A discussion of the possible introduction of effective natural enemies arouses hope that relief will be obtained from that source, but this hope should not lead the ranchers to discontinue their own individual efforts.

Cooperation by Federal Authorities. While in Washington it was the privilege of one of us (Van Dine) to bring to the attention of Dr. Howard, the details of our ranch conditions and to emphasize the importance to our live stock industry of gaining relief from the horn-fly. At the time of this conference

(last April) Mr. Howard was about to sail for Europe on the work of the importation of parasites for the Gypsy and Brown-Tail moths of New England, but took the time to outline at once a program to aid the Hawaiian stockmen. Field Agents of the Bureau in the West and South were instructed to begin breeding experiments to determine what special enemies of the horn-fly, if any, exist in the United States. These experiments have continued since that time and Dr. Howard says in a recent letter that "I am having extensive breeding work carried on in different sections of the country with the view of securing horn-fly parasites to send to you for possible introduction into Hawaii. I recently visited our laboratory at Dallas, Texas, where Mr. Pratt, of this Bureau, is carrying on large rearing experiments, and was much interested in his results."

Observations Made in Texas. During the latter part of May, on the way home, Van Dine visited Southern Texas and at Victoria, Mr. J. D. Mitchell, a Special Field Agent of the Bureau, had already begun breeding experiments relating to the horn-fly. At that season the horn-fly had reached the spring maximum and was generally abundant. Important natural checks in that section are low temperature and lack of moisture. In Texas the horn-fly begins to increase as the weather becomes warmer which is about the first of March. What is termed the first maximum is reached in May. From May on, dryness prevails and the fly decreases until the fall rains begin and then increases towards the second maximum which is checked when frost appears in the latter part of October. From October to March there is a decrease due to low temperature.

In a recent letter, Mr. Mitchell says that "The past summer has been so long, so hot, and so dry that all flies that breed in cow dung are reduced about 95 per cent to what they were in May last. The manure dries before the larvae can pupate and and where the manure is thin, the intense heat cooks the larvae outright. We have had rain recently (during October) and the weather is cooler, and I can see quite an increase in horn-

flies. I have kept several breeding cages going all summer." One point obtained from the tick eradication work in Texas of interest in relation to the horn-fly is that in dipping cattle fully 80 per cent of the adult horn-flies are killed. This is brought about by their habit of hovering close to cattle even when dipping operations are being carried out. This relief is of course only temporary.

Spraying for Horn-Flies. Quite recently a new process of destroying skin parasites on live stock on a large scale, by means of spraying, has been invented by Dr. Geo. T. Seabury, former State Veterinarian of Wyoming. The two accompanying cuts show the spraying machine and the manner of operation. The process, which is endorsed by the U. S. Bureau of Animal Industry, has proved very efficient and at the same time humane, as compared to the old method of dipping in a vat. The preparation used in the machine and which has proved absolutely satisfactory not alone in protecting the animals from the attack of flies for a certain period, but also for the destruction of flies, ticks, lice, warbles and mange parasites, is very cheap and consists of an emulsion of crude oil in water in the proportion of 20 gallons of oil to 80 gallons of water, with the addition of 5 lbs. of soap. It is claimed that the oil remains on the cattle from six to eight weeks after application and prevents the reinfection with skin parasites, but in the writers' opinion a single spraying will not protect the animals from attacks by flies for any such length of time. We believe, however, that great benefit can be obtained from the use of this machine in the wholesale destruction of the adult flies, especially so far as cattle in fattening paddocks are concerned.

It is a well known fact that cattle in a fattening paddock cannot be finished for market while the flies are bad, even when the feed is excellent and abundant. It would therefore seem a paying investment if such cattle could be submitted to one or two sprayings thereby affording them perfect rest for at least a month or six weeks before going to market.

The spraying machine in question is portable, that is, the entire outfit, including the gasoline engine, can be hauled on a common farm wagon with a light pair of horses over any kind of road. To install it for use will, however, require pens and chutes as well as a portable tank to contain the oil emulsion. This tank or trough is set in the ground under the machine and serves at the same time as a receptacle for the waste emulsion.

Freeing a Pasture of Horn-Flies. The habits of the horn-flies are such that they never leave the cattle for any great distance or for any length of time. Whether they rest on foliage or grass is not known, but it is safe to conclude from the observations of many investigators and from our own experience that when all of the animals in a pasture are rounded up nearly one hunderd per cent of the adult flies are around or in the neighborhood of the animals, including the cow-ponies. As the flies are very light and so far as is known are not in the habit of traveling or migrating, they are easily carried by the wind. To free a pasture from adult flies would, therefore, simply require that all animals be rounded up and driven with the wind out of the pasture and then put through the spraying machine and back into the same pasture against the wind. To prevent any of the flies returning with the cattle it might be well to build a funnel-shaped canvas-covered guard at the entrance to the machine and a long brush-covered chute at the exit. Two weeks after the first spraying the operation should be repeated in order to destroy the horn-flies which had developed since the first treatment. It is a safe conclusion that all of the flies which are left behind and which are not destroyed in the spraying will assemble on or around the horses of the cowboys and annoy them greatly and if any cowboy returns to the presumably clean pasture thousands of them will follow him.

Still better results might be obtained if the pasture to be freed from flies could be left empty for from two to four weeks after the cattle and flies have been removed, but until something definite is known as to what becomes of horn-flies which are

hatched in the pasture where there are no animals to feed on, how long they can live without food and what distances they will travel in search of food, nothing certain can be said in regard to the length of time the pasture should be allowed to rest to completely free it from the flies. From deductions made from observations of other species it is, however, safe to conclude that the above mentioned period, two to four weeks, would be sufficient for the greater majority of them to die.

The Spraying Machine. The spraying machine in question which is manufactured in Denver is patented and the price quoted is $600., exclusive of the required eight-horse power gasoline engine. Negotiations have been entered into with the company for the right to manufacture the machine here as the freight from Denver would add to the cost considerably. When a definite proposition has been received the same will be submitted to the members of the Stock Breeders' Association for their consideration. In the mean time an effort will be made to obtain funds for the purchase of at least one machine for experimental purposes, as the writers feel convinced that the horn-fly pest could be checked to a very great extent while efforts are being made in finding and testing natural enemies.

Testimonials furnished by prominent and well-known stock raisers in Texas, Wyoming and Montana are all to the effect that the animals begin to put on flesh immediately after spraying, that no animal has ever been known to be injured during the process and that where sprayed and unsprayed cattle are grazing together the former can be recognized at a distance by the way it feeds without fighting flies with head and tail.

It may finally be added that with a good round-up crew the machine can take care of three to four thousand head of cattle in a day.

Trapping the Adult Flies. Another manner of destroying the adult flies on a smaller scale and without any considerable outlay is by trapping them. The writers have no personal ex-

perience along this line but quote the following from the Denver Field and Farm of April 25th, 1896:

"The flycatcher is a kind of covered pen or passage-way through which the animal must walk to secure relief. A few feet from the entrance there is a cupola or dome in the roof of the passageway, made of glass, and arranged as a flytrap. Beyond this the passageway is in darkness. The animal walks through the machine, and just as it passes the dome and enters the darkened part a set of brushes sweeps off the flies, which naturally rise into the lighted dome, and the steer passes out at the other side free from flies. The flies are retained n the dome trap. The inventor has experimented with his machine, and finds that animals soon learn the value of the machine, and know enough to walk through it when the flies begin to bite. The device is said to be patented, but a plan involving the same principles has been in use among farmers for the destruction of horn-flies for a year or two past."

This plan would seem to be especially well adapted for dairies, if it could be so arranged as to compel the animals to pass through the passage-way every time they are brought home for milking.

Destruction of Larvae in the Dung. To attend to the individual droppings of animals, however small the number and however easy the method, is practically out of the question. It is only where the application of remedies can be done on a scale promising actual returns in proportion to the time and labor expended that this method of control can be at all considered.

It has been estimated that perhaps fifty per cent. of the developing flies can be found in the dug in the vicinity of watering places, pens and shady retreats. The cakes are found in greater numbers and more eggs are probably deposited in them than in those which are dropped in feeding over the range. The same applies to cattle yards near dairies or farms where the animals are being held at milking time. Appropriate treatment of the dung in these places would, therefore, destroy a proportionately large number of larvae. For the benefit of cattle owners and especially dairy men who might wish to attempt this method of eradication we quote the following:

"For the destruction of the larvae, which is probably the more effective way of preventing damage, two principles have been established. The first involves the killing of the maggots by introduction of some destructive agent; the other, the prevention of their maturity by the rapid drying of the mass of dung which supplies their food. The use of lime, as originally suggested in Insect Life, is a very effective plan, and where not prohibited by expense should be generally adopted. Professor Smith's suggestion to spread out the droppings of manure so that they may dry rapidly is applicable during dry weather and in some localities is accomplished by drawing brush across the fields, a method which must necessarily fail to be complete in its operation, but much less expensive than the use of a shovel by hand."[1]

A still more inexpensive method of scattering the dung in yards and pens is to allow a number of pigs to run with the cattle. In their efforts to obtain undigested particles of food they will effectively destroy the cakes as breeding places for the fly larvae, at least during the dry season. This is especially noticeable in cattle feed yards on the mainland, where hogs always follow the cattle, and to a certain extent in the algaroba belts of these Islands.

Birds as Enemies of the Horn Fly.

Last year one of the writers (Van Dine) was sent to Washington to look after the interests of the bee-keepers of the Territory. As the bee industry and the live stock industry in many cases are closely allied the opportunity was taken advantage of to confer with the Bureau of Biological Survey of the Department of Agriculture in regard to the possibility of introducing insectivorous birds that would aid in checking the development of flies on our ranches. Prof. Henshaw, the Acting Chief of the Bureau, was consulted along these lines as well as in regard to the introduction of the turkey-buzzard to feed on dead bodies of cattle and sheep and thus destroy the breeding places of

[1] Osborn. Insects Affecting Domestic Animals. U. S. Dept. of Agri., Bureau of Ent., Bul. No. 5, 1896, p. 121.

various flies. The latter subject will be discussed under the heading of "The Sheep-Maggot Fly," and extracts of the correspondence pertaining to insectivorous birds are submitted herewith:

(Van Dine to Prof. Henshaw, July 20, 1907.)

"I have read your Circular No. 56 and believe a lasting benefit could be conferred upon Hawaii by the introduction of certain birds. Bryan's idea in establishing an observational aviary in Honolulu is undoubtedly the way to go at the project, and I think that if the people here could be made to see the economic value of such an affair it could be brought about. Of course my interest is confined to the insectivorous birds, and I wish particularly that we could get some birds that would feed upon insects in dung. An old-time Californian informed me that Brewer's black-bird feeds exclusively upon insects and will scatter cow-dung completely about in its effort to obtain the insects developing therein. If true, this would be a fine thing in our horn-fly problem here. Will you give me any information you can on this or other dung-feeding birds?"

(Prof. Henshaw to Van Dine, August 5, 1907.)

"I have always believed that it was advisable to introduce certain insectivorous birds into Hawaii, but one cannot be too cautious in their selection of the particular birds. We regard Brewer's blackbird in the United States as a valuable species. It feeds about corrals and is particularly fond of feeding around cattle, nevertheless, it destroys considerable corn in certain localities. With us it does more good than harm, but the question is how the bird would affect the rice plantations in the Islands. The corn crop is not extensive enough to be much damaged, but if the birds should increase and acquire the rice-eating habit, which is by no means impossible, the results can hardly fail to be disastrous.

"So far as the horn-fly is concerned, the cowbird would undoubtedly be one of the very best species to introduce, but the cowbird is open to the same objection that Brewer's blackbird is, namely, the danger that it would attack rice or grain. It is to be remembered also that while both these birds would unquestionably attack the larvae of the horn-fly successfully they would also eat all the useful Carabidae.

"There is one bird which may be introduced into the Islands with absolute safety and, although its habit of feeding on dung insects is not so pronounced as in the case of either of the above blackbirds, it would yet render good service in that way. This is the meadow lark. The only trouble that I know of with this lark is that it would be subject to attack by the mongoose as it invariably breeds on the ground. Otherwise, I should recommend it unhesitatingly.

"Why not try some of the flycatchers? Almost any of the true flycatchers that are found on the West Coast would be serviceable and I do not see that they can do any harm. It would be difficult to transport the swallows to the Islands from the States, but once there, their value cannot be doubted. Unquestionably they would attack the horn-fly with vigor.

"I will close by simply stating that if you can guarantee the Brewer blackbird will not attack rice, that is your bird so far as the horn-fly is concerned."

(Van Dine to Prof. Henshaw, Sept. 13, 1907.)

"Brewer's blackbird would indeed be a bad acquisition if it destroyed rice to any extent. I think from what you say in your letter, that the meadow lark and some of the fly-catchers would be the only birds we had best undertake to import without very careful observations on their habits. This kind of work we are not in a position to undertake, and it simply emphasizes the importance of establishing here an aviary for such investigations. This, you know, has long been recommended by Bryan at Bishop Museum, and I would like to see him receive the necessary financial support to carry out his ideas. I wish you would tell me in detail what our part of the work would be in getting the meadow lark and some of the fly-catchers here."

(Prof. Henshaw to Van Dine, Nov. 2, 1907.)

"When it comes to the practical business of getting suitable birds from California to the Islands the problem begins to assume a rather serious aspect. I do not believe that an application to import birds for purposes of propagation will meet with any opposition from the State Game Commissioners of California, but I confess that I am at a loss to suggest means of obtaining the birds, even assuming that you had abundant means. Take the short list of birds I give below: meadowlark, ground towhee (Pipilo crissalis), lark finch (Chondestes grammacus), horned lark, bluebird, and black phoebe. All these

birds are abundant in California, most of them are right hardy, and I think all of them would thrive under island conditions. The black phoebe as an insect-eating bird would be particularly valuable, as it is a good breeder, somewhat domestic in its habits, and a very active fly-catcher. The other species are all adapted to life in the more or less open island districts, and would thrive particularly well in such regions as the Puna region of Hawaii. But how are you to obtain the necessary number of individuals? In order to experiment properly you should have not fewer than 25 birds, and I do not see how these are to be trapped. It is possible that Mr. Leverett M. Loomis, Director of the California Academy of Sciences, would be able to suggest the names of parties from whom some at least some of these birds might be obtained in numbers, and it might be a good idea for you to address a letter to him on the subject. Perhaps the better way would be to try the experiment on a small scale at first, and the introduction of the meadow lark would probably be the easiest species to obtain and transport. The horned lark, the pipilo and the lark finch are all seed-eaters, but when they cannot obtain seeds they live largely on insects, and all of them are lowland birds. It seems to me that it is much more important to procure species that will live in the lower districts now practically unoccupied by bird life than to try to import species that will resort to the woods where practically nobody will see them.

"I may add that I do not consider the importation of a wholly insectivorous species, like the black phoebe, to be practicable, for I do not know of any way in which such birds can be fed, unless possibly they could be induced to take meal worms, and so far as I know, this experiment has not been tried."

The writers have taken up the possibility of the introduction of certain fly-eating birds with Mr. Wm. A. Bryan of the newly organized Scientific Institute of the Pacific and Mr. Bryan offers every encouragement that desirable birds for the purpose in view can be secured and successfully introduced but emphasizes the necessity of careful local observations on their habits and feeding tendencies before liberation. We are assured by Mr. Bryan that the introductions will be undertaken as soon as

provisions are made for the establishment and equipment of an aviary.

The Warble-Fly and the Heel-Fly.
(*Hypoderma bovis* Deg. and *H. lineata* Villers.)

One, and possibly both, of the bot-flies attacking cattle have been brought to Hawaii with imported cattle. So far neither of them seem to have become established here.

These flies produce a condition known as bots or warbles or "grub in the back" of cattle.

General Characteristics and Habits. Bot, or Warbles. Two kinds of bots (Hypoderma bovis and H. lineata) infest American cattle. They represent the larval stages of the heel fly. The adult flies are about half an inch long and resemble bees somewhat in appearance. They appear in warm weather and lay their eggs, especially in the open, upon cattle, often frightening the stock, making them nervous, and even causing them to stampede. It is maintained by some authors that the flies puncture the skin in laying the eggs; other authors deny this, maintaing that the cattle lick the eggs from the skin, so that the infection is through the mouth. Young bots are found in the wall of the esophagus; older bots appear under the skin at various parts of the body. They are also occasionally found in other places, such as deeper in the back, in the spinal canal, etc. The bots are in the body by October or before, and they appear under the skin along the back by January; here they grow until March, April, or May, forming the well-known lumps. When mature, the bots work their way out, fall from the cattle, burrow into the ground and remain there as pupae for about a month, when the adult fly issues. The adult fly does not bite.

Bots weaken animals, cause a decrease of milk and flesh, and reduce the value of the hide. It is estimated that ox warbles result in a loss to this country of $35,000,000 to $60,000,000 a year.[1]

---

1 Special Report on Diseases of Cattle. Dept. of Agri., 1904, p. 478.

Preventive and Curative Measures. From the above description it would seem that every effort should be made to prevent the introduction of these flies into Hawaii, but owing to the fact that the larval stage occupies more than six months and that for the greater part of this time the presence of the larvae in the body of the animals is not discernable, it has been found impossible to make regulations for the prevention of their introduction. It is not until the larvae appear in the hide of the back that measures can be taken for their destruction and importers of stock are, therefore, urged to examine their imported animals regularly every two or three weeks for at least six months after arrival.

When the larvae appear in the back they are easily destroyed either by injecting a few drops of kerosene oil through the opening in the swelling, which can be done by using a machinist's oil-can, or by placing a daub of Stockholm tar over the opening. When the warbles are nearly mature and have begun to extend part of their bodies through the openings they may be pressed out by placing the mouth of an empty bottle on top of the swelling and by steady pressure force the larvae out.

Economic Importance. During the year of 1904 this Territory exported to the Mainland of the United States $73,000 worth of hides and skins,[1] besides what was manufactured into leather and sold to the local trade. There is, therefore, as stated, every reason why this parasite should be kept out of the Territory and it will depend entirely upon the importers of breeding and dairy cattle to see to it that none of the larvae mature and escape from the animals before they are destroyed.

Though no regulation has been promulgated to that effect, the office of the Territorial Veterinarian has made it a rule to thoroughly disinfect the hide of all imported cattle immediately after arrival and to destroy all warbles which at that time have made their appearance under or in the hide.

---

1 Annual Rept. Bureau of Animal Industry, U. S. Dept. of Agri., 1904, p. 503.

The fact that the adult fly has not been observed here would seem to indicate that natural enemies are present, as the climatic conditions would be favorable for the development of the fly throughout the year. The following account of the manner and extent of injury from these flies is here included to emphasize the necessity for local inspection and subsequent cooperation on the part of the importers. While we congratulate ourselves on immunity it is well to keep in mind the necessity for continual vigilance.

The losses from warble flies must be considered from three distinct points, only one of which can be estimated with any great accuracy. They are (1) the loss incurred on the hides perforated by the maggots, subjecting them to discount or rejection in the markets; (2) the loss in milk and beef supply caused by the fretting and stampeding due to the presence of the flies when laying eggs, and (3) the loss to the vitality of the animal, its weakened condition, and consequent loss in milk or beef due to the presence of the warbles, with accompanying ulcers in the back, sometimes, it is asserted, resulting in the death of the animal.

The loss on hides will vary in different countries, both from the actual differences in abundance of warbles and consequent perforations of the hides and from the different rates of discount applied by different dealers.[1]

The Hawaiian Sheep-Maggot Fly.
(*Calliphora dux* Eschscholz.)

A number of flies have the habit of depositing their eggs in either fresh or decaying meat when the same is left exposed to their attack. Some of these flies deposit their eggs in wounds of living animals when the same are left unattended and become foul.

During the War of the Rebellion wounded soldiers left on the battle fields over night frequently had their wounds blown

1 Osborn. Insects Affecting Domestic Animals. U. S. Dept. of Agri., Bureau of Ent., Bul. No. 5, 1896, pp. 88, 89.

and suffered greatly in consequence. Epidemics of blow-fly have, however, been practically unknown until recently. On the Mainland of the United States the only fly of this class which causes trouble of any consequence is the screw-worm fly (*Compsomyia macellaria*) and this species very rarely attacks sheep. In his report to the Stock Breeders' Association Norgaard described a few cases of screw-worm in sheep which had come under his personal observation in this Territory, and warned against the danger of this fly gaining a foot-hold here. Since that time only one case has been observed, but the screw-worm fly has been supplanted by a new species, *Calliphora dux*, which has worked great havoc among the sheep and lambs on various islands of this group.

Similar epidemics, though less severe, have been reported from Australia. The Hawaiian and the Australian flies in question, though different species but closely related, have in neither case been known before to attack uninjured living animals. The English blue-bottle fly (*Lucilia sericata*) has on the other hand been known for years as a troublesome insect to sheep at certain times of the year and under certain conditions, which will be referred to later.

A New Parasite Fly. The Hawaiian sheep-maggot fly was first collected by us on Molokai and was forwarded to Washington for determination. Mr. D. W. Coquillett of the Bureau of Entomology of the Department of Agriculture determined it as above. The species has never been recorded from the Territory of Hawaii and is here treated for the first time as an animal parasite. No reference can be found in the literature on animal parasites, where a practically obscure species, supposedly infesting only dead animal tissues, has so suddenly adapted itself to living animals with such serious results. The outbreaks that have thus far come to our notice are sufficient to place the species in the front rank as the most serious pest that stockmen in Hawaii will have to deal with where sheep raising is of importance.

The fly is probably of comparatively long standing in this Territory, and while details are not at present worked out, enough information is at hand to show that sporadic cases of "blown" sheep have occurred in past years without epidemics resulting from them. Our understanding of our own species has been extended by references to similar injury to sheep from different, though related, species in the British Isles and Australia. The problem is far from solved and calls for extended and detailed study before definite conclusions can be given.

Characteristics and Habits. The fly itself can be recognized as the bluish green metallic species that breeds wherever decaying flesh is left exposed. On the ranches where it occurs, it is always attracted in numbers when slaughtering an animal. The fly will "blow," that is, deposit its eggs, on any exposed meat or in any wound, but preferably when the same has become foul. Its development as a parasite of sheep in this Territory began by the fly blowing the scars from sheep-scab that had been irritated to bleeding by the horn-fly. The attack of the fly, combined with the sheepscab and horn-fly injury resulted in some instances in the death of the animal and from the carcasses of the dead sheep innumerable flies developed. From this source, the dead bodies, the fly became epidemic and began to blow not only the sheep-scab wounds but dead wool and wool fouled in any manner, especially that about the crutch of sheep and lambs suffering with the scoures.

When the eggs are deposited on wool the resulting maggots, which appear within twenty-four hours, work down through the wool to the body. They do not attempt to penetrate the unbroken skin, as do the screw-worm maggots, but work in a constantly moving intermingled mass over the surface, causing irritation which brings about inflamation, suppuration and ulceration, on the products of which the larvae feed. Then the wool drops off leaving a festering ulcer that is being constantly reblown, while masses of eggs are also being deposited in the filthy wool surrounding the sore. Such an infestation of one

week's standing will contain maggots in all stages of development as well as unhatched eggs. When the skin is completely destroyed the maggots penetrate with ease in all directions under the skin, forming pockets, fistulas and sinuses and the animal dies from septicemia or exhaustion.

As the maggots mature they drop to the ground and pupate in the soil. Observations to obtain the length of time for development of larvae and pupae and to obtain other facts concerning the life-cycle are now in progress. The life-cycle does not extend over three weeks and the larvae or maggots develop in less than ten days.

CURATIVE AND PREVENTIVE MEASURES.

Local Treatment. Without going into the details of our efforts to eradicate the blow-fly from infested local herds, the measures employed at the present time are here presented. We have so far failed to find a remedy that in one application will kill the maggots, disinfect the wound and prevent reinfection. The present treatment is a dual one. All loose foul wool is removed and destroyed and the wound and surrounding skin treated with a mixture of chloroform and kerosene oil in the proportion of 1-10. This dislodges and kills all the maggots. An application is then made with a brush of a mixture of flowers of sulphur and Stockholm tar in equal proportions by measure, to which has been added a small amount of sperm oil (1 quart to 5 gallons of the mixture) to give elasticity to the resulting crust. The wound heals well under the crust, which not alone protects it from being re-blown but also from attacks by the horn-fly. With the exception of very aggravated cases one treatment is as a rule sufficient, but the treated animals must be watched closely, as they are likely to bite at the crust on account of the itching which accompanies the healing process.

Disposal of Affected or Dead Animals. By far the most important measure in dealing with an epidemic of maggot-flies is to locate the affected animals, and this is, to say the least,

extremely difficult when the animals are on the open range or in large paddocks, and, with sheep which are not used to being herded, it is impossible to get near enough to them without rounding up the entire bunch and examining them in a corral. On the open range or in paddocks containing perhaps 10,000 acres only the very worst cases can be seen when they lag behind the bunch from weakness. Such animals may just as well be killed and buried on the spot, and care should be taken to bury them deep enough to exclude the possibility of newly hatched maggots working down to them, as the stench which rises to the surface from a carcass in a shallow grave, will cause numerous flies to deposit their eggs on top of it. The writers have seen such a grave, from which the egg masses could be scooped up in double handfuls. This fully illustrates the necessity for disposing effectively of all dead animals, and especially during an epidemic.

Destruction of Eggs and Maggots. Equal care must be taken in destroying all eggs and maggots in pens where affected animals are being dagged or treated. We have seen in such a pen the ground completely covered with newly hatched flies, sitting so close together as to lend a greenish sheen to the surface. Two or three weeks before this observation was made a number of sheep had been treated there for maggots.

The affected animals should be doctored and sheared on a piece of canvas or a wagon sheet and the rubbish collected and burned.

THE TURKEY-BUZZARD AS AN ENEMY OF MAGGOT-FLIES.

The fact that neither mammalian nor avian scavengers exist in these Islands led us to make inquires in regard to the introduction of the turkey-buzzard. While in Washington one of us (Van Dine) conferred with Prof. Henshaw on the subject, who was then in favor of its introduction here. Since that time the following correspondence has taken place:

(Van Dine to Prof. Henshaw, July 29, 1907.)

"I had a very interesting trip in So. Texas and I want to write you particularly in regard to certain information concerning the turkey-buzzard given me by cattlemen in that country. You remember I mentioned introducing this bird into Hawaii to feed upon the carcasses of sheep and cattle on our ranges. The cattlemen tell me that the bird is a great nuisance for the reason that it fouls the drinking water. There will be a good supply of grass and water but they will visit the range and find the cattle not feeding but collected about the drinking places and will not drink until the troughs or tanks are cleaned and fresh water supplied. They also say that the buzzard picks the eyes out of young pigs and will take off their tails and ears. Mr. J. D. Mitchell of Victoria, Texas, could give you more detailed information on the behavior of the buzzard on the range if you desire it."

(Prof. Henshaw to Van Dine, Aug. 5, 1907.)

"Since seeing you I have learned one or two facts about the turkey-buzzard which would require careful consideration before its introduction into Hawaii.

There is no doubt that the bird fouls drinking water in the State of Texas, and perhaps elsewhere, although until recently I was not aware of the fact. My acquaintance with the bird has been long, and the same may be said of most of the members of our Survey, none of whom appear to have any knowledge of attacks by the bird upon living animals. Nevertheless, it is possible that in the case of newly born young, or of sick or helpless animals, the bird occasionally may attack them. I believe such cases are so rare, however, that they should be allowed little weight in considering the advisability of introducing it abroad.

There is, however, another and very important reason for exercising caution in introducing the bird into Hawaii, which has only very recently come to my knowledge. It is thought in Texas that the buzzard is instrumental in spreading disease by feeding upon dead cattle and then distributing bacteria among forage grass by means of its excrement. I am not aware that

this has actually been proven as yet, but it has at least been suggested as a reason why the birds should be exterminated over the cattle ranges of Texas; and if there is even a fair degree of probability that the bird spreads cattle disease it should make us very cautious about recommending its introduction in any region or country where the cattle business is important."

This ended further consideration of the subject for the time being. Norgaard is, however, of the opinion that there would be little or no risk connected with the introduction of these birds as long as proper precautions were taken to see to it that no diseases were introduced with them.

In his opinion the buzzard undoubtedly scatters blackleg and anthrax over the Southern States by feeding on the carcasses of animals which have died from these diseases, both of which are caused by spore-bearing bacilli. But neither of these diseases exist here, nor so far as is known any other transmissible disease which could be carried by the buzzards. On the other hand the question arises, what would have become of the live stock industry in Texas and other stock-raising southern and western States if it had not been for the scavenger work done by the buzzards and the coyotes.

The loss of sheep in this Territory during the past year alone, and which to a great extent could have been kept in check by buzzards, was so great that further consideration must be given to the question of their introduction, especially if the fly pests should continue unabated during the coming season.

MULE BREEDING IN THE TERRITORY OF HAWAII.[1]

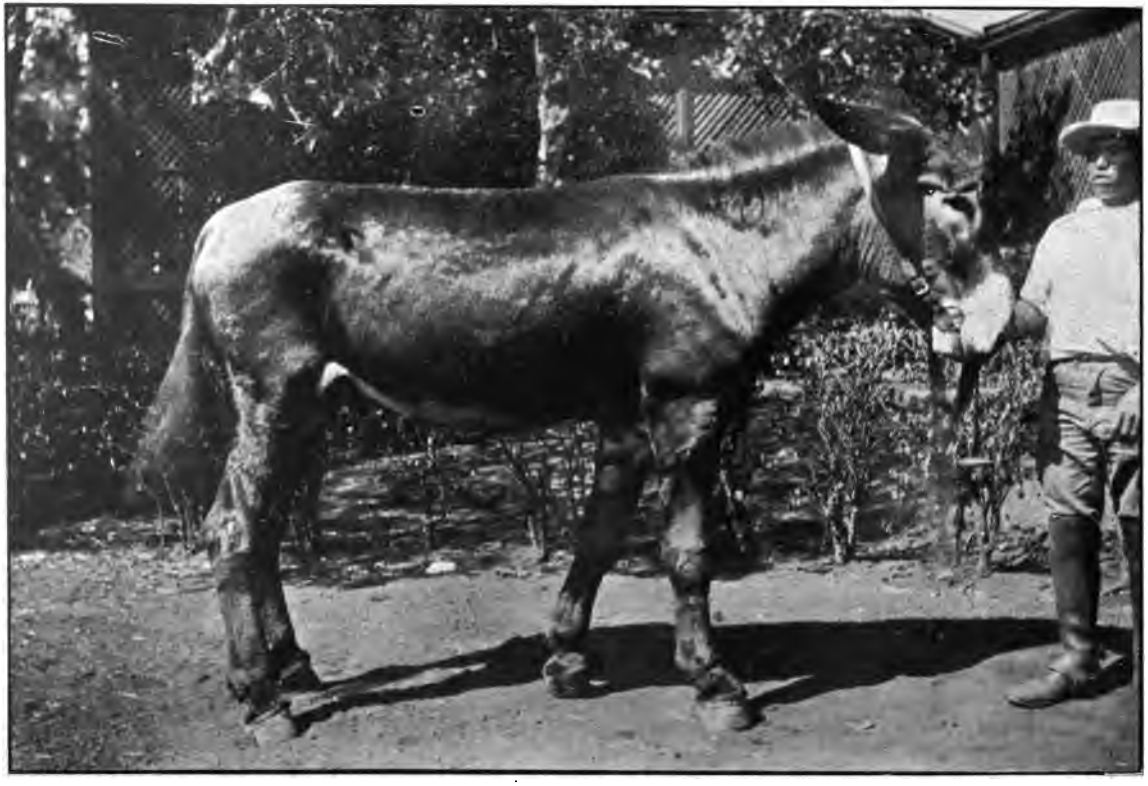
It has, during the period that I have held office here, been one of my principle aims to encourage the introduction of breeding stock for the purpose of improving the stock already here with the view to enabling the ranchmen and stock raisers ultimately to supply the local demand for all classes of food or work

[1] From a report by the Territorial Veterinarian at a meeting of the Board, Sept. 26, 1907.

animals. I was early impressed by the large annual importation of various classes of live stock from the Mainland, principal among which was the importation of mules. During the past two years approximately 300 head of mules per annum have been brought to this Territory, principally from California. At a low estimate, these animals cost delivered here an average of $225 per head, or an aggregate of $135,000 for the two years. If the prices of mules during this period had not been so exorbitant, I am of the opinion that at least double this number would have been imported. Mules have, however, increased from 75% to 100% in value during the past five years, and the sugar plantations have refrained from buying mules unless absolutely compelled to do so, with the result that at the present time there are very few plantations in the Islands whose stables are not more or less depleted, in regard to the number of mules on hand as well as to the age and condition of the animals. There is, unfortunately, no prospect at the present time, or for several years to come, of the price of mules going down. The necessity of this Territory's producing its own mules is therefore obvious, and that this can be done by supplying the requisite amount of bone building material to the brood mares and the young stock has already been demonstrated.

On the Molokai Ranch good mules have been produced without any difficulty, and I have no doubt that if these mules, 16 of which were sold a short time ago for prices nearly double those ever been obtained for Island bred mules before, had had access to bone meal from the time they were born, instead of for only the past year and a half, they would have been in no way inferior to the animals now being imported from California. I have therefore endeavored to get the local stock raisers to go in for mule breeding on a large scale.

In order to breed first-class mules it is necessary to have first-class jacks and as large mares as can be obtained, and I am therefore pleased to report to you that a number of breeders



JACK IMPORTED FOR THE PUAKEA RANCH, HAWAII.

and ranchmen have decided to import first-class jacks from Kentucky and Tennessee. One agent has already left for these states and another will leave in the course of a few days. They will select about 6 or 8 jacks and will be assisted by an expert recommended by the U. S. Bureau of Animal Industry. Every effort will be made to secure the very best animals which can be found. Two ranches have also ordered a number of large mares, though it is the intention of most of the breeders to utilize the mares already here, or to raise large mares by means of the bone meal process and ultimately utilize them for mule breeding.

Another point in connection with this move is the encouragement which farming or the production of feed stuffs will receive through the presence of an abundance of work animals. To produce first-class mules a certain amount of concentrated feed must be given, and as young mules must be broken to harness and their muscles developed through steadily increasing work before they can be considered finished plantation mules, this process of breaking and developing can be made profitable by making them produce their own feed. Suitable tracts of land should be selected on every breeding farm or ranch especially with a view to irrigation. These lands may be plowed, harrowed and planted, and the crops harvested and hauled by the young mules, care being taken not to overwork them.

When it is further considered that it requires practically the same length of time to raise a mule as to raise a steer, and that when ready for market the former is in strong demand at five times the price at which the latter often goes begging, there can be little doubt that mule breeding in this Territory will prove profitable to the stock raisers and ultimately, in regulating the prices by a constant and abundant supply, prove beneficial to the planters and agriculturists.

AN IMPROVED VETERINARY SANITARY SERVICE FOR THE TERRITORY OF HAWAII.

Reports and Correspondence pertaining to the appointment of Deputy Territorial Veterinarians for the Islands outside of Oahu.

It has, during the past two years, become more and more apparent that the total absence of experienced veterinarians on all of the Islands with the exception of two, (one of which, Hawaii, can only muster but one practising veterinarian) has made it next to impossible to carry out the spirit of the law which more than two years ago established the office of Territorial Veterinarian and Superintendent of Animal Industry. The difficulty in reaching, on short notice, plantations and ranches on any of the Islands, except Oahu, has in many cases caused considerable losses which, to a certain extent at least, might have been avoided if a veterinarian could have been reached without delay. It would, therefore, seem desirable if a number of young veterinarians, recent graduates of first-class veterinary colleges, could be induced to come to these Islands for the purpose of locating here permanently. To realize this, however, it will be necessary to guarantee a certain monthly income and perhaps to assist in the matter of traveling expenses. My idea would be to get three or four young veterinarians to come here; one to be stationed in Lihue, Kauai, one at Wailuku, Maui, and one at respectively Kamuela and Hilo, Hawaii. These veterinarians should be guaranteed by the Hawaiian Sugar Planters' Association and by the Hawaiian Cattle Raisers' Association an income of $100 per month, the same to be assessed at a proportionate scale on the various plantations and ranches within the district or territory in which the said veterinarians would be located. In return for this salary the veterinarians should attend to all outbreaks of infectious

[1] Report submitted by the Territorial Veterinarian at a meeting of the Board of Commissioners of Agriculture and Forestry, on October 3d, 1907.

and contagious diseases as well as to the inspection of all imported stock, free of charge. On the other hand the veterinarians should be allowed to charge for any other professional services, and for the treatment of all diseased animals, whether medical or surgical. The said veterinarians should be appointed Deputy Territorial Veterinarians by this Board and should report to the Territorial Veterinarian on all outbreaks of infectious or contagious diseases as well as on the inspection of imported live stock.

If such an arrangement could be effected, all managers of plantations or ranches could obtain the services of a veterinarian within a few hours after any suspicious symptoms might have been noticed among their stock and the attending veterinarian could take such precautions as would tend to prevent an outbreak from becoming epidemic. In the mean time he would report to the Territorial Veterinarian, who, at his discretion, would either make a personal investigation or send the necessary directions for the inspector to be guided by.

The monthly assessment of each plantation and ranch would be trifling and would, according to my estimate, vary from $5 to $10 per month on the Islands of Maui, Hawaii and Kauai, while the Islands of Oahu and Molokai would be attended to from this office as hitherto.

I have discussed the proposition with various managers and have so far met encouragement from all. There is, at a conservative estimate, at least $1,500,000 invested by the various plantations in mules and horses, that is, in draft animals without which the sugar industry would be crippled. With the prices which mules and horses are commanding at the present time it would seem that there is every reason for preserving those now on hand and for protecting those which are constantly arriving to take the place of those that have served their time.

I beg therefore to submit for the consideration of this Board the above described move for a more efficient veterinary inspection service and to ask for your instructions in regard to the further development thereof.

Honolulu, Hawaii, Oct. 4, 1907.

Mr. J. P. Cooke,
President Hawaiian Sugar Planters' Association,
Honolulu.

Dear Sir:

At a meeting of the Board of Commissioners of Agriculture and Forestry on the 2d inst. a report was submitted by the Territorial Veterinarian in regard to an improved veterinary service in this Territory.

I enclose herewith a copy of this report and would like to hear your opinion on the same.

The members of the Committee on Animal Industry are Mr. George R. Carter, Mr. L. T. Kellogg and Mr. P. R. Isenberg. Dr. Norgaard will also call on you at your convenience in order to furnish any additional information which you may desire.

The Hawaiian Cattle Raisers' Association has practically been dissolved, but it is believed that $100 per month can be collected through stock taxes or by subscription from the individual stock raisers.

Very respectfully,
(Signed) C. S. HOLLOWAY,
President and Executive Officer.

Hawaiian Sugar Planters' Association.
Honolulu, T. H., Nov. 21, 1907.

The Board of Commissioners of
Agriculture and Forestry,
Honolulu.

Gentlemen:

On October 4th you addressed a letter to the President of the Hawaiian Sugar Planters' Association enclosing a report or recommendation by Dr. Norgaard to your Board relating to an improved veterinary service in this Territory.

Dr. Norgaard's recommendation was that four veterinarians be employed, to be stationed at Lihue, Kauai; Wailuku, Maui; and two on Hawaii, and that they should each be guaranteed by the Hawaiian Sugar Planters' Association and by the Hawaiian

Cattle Raising Association an income of $100 per month, and that in return for said salary they should attend to all outbreaks of infectious and contagious diseases as well as to the inspection of imported stock free of charge; but that the veterinarians should be allowed to charge for any other professional services rendered.

At a recent meeting of the H. S. P. A. this matter was discussed and referred to the Trustees of the Association for investigation. In order that the Trustees may be fully informed in this connection, I am now instructed to ascertain from you the following:—

Does the Board of Commissioners of Agriculture & Forestry favor the employment of veterinary surgeons as recommended by Dr. Norgaard, and is the Board prepared to pay anything toward the salaries of such veterinarians?

What authority will be conferred by the Board upon the veterinarians if they are so employed?

What charges would these veterinarians be allowed to make in the way of fees performing inspection service, or is it intended that, as recommended by Dr. Norgaard, the salary of $100 per month should cover all inspection charges?

As the amount of $100 per month undoubtedly would not be sufficient compensation to induce any skilled veterinarians to come here, what additional compensation in your opinion would be required to be guaranteed, in order to secure suitable men?

If the veterinarians are allowed to charge for professional services other than for inspection, and in attending to outbreaks of infectious and contagious diseases, is it your idea that they should also charge the plantations or others contributing towards their salaries?

The sugar plantation interests are alive to the matter of having skilled veterinarians to inspect their stock and to guard against outbreaks of infectious diseases, but before entering into any guarantee such as recommended by Dr. Norgaard, they

desire first to ascertain just what is expected of them, and an early reply to this will be appreciated.

Yours truly,
(Signed) ROYAL D. MEAD,
Asst. Secty.

Honolulu, Hawaii, Dec. 9, 1907.

Mr. Royal D. Mead,
Assistant Secretary,
Hawaiian Sugar Planters' Asso.,
Honolulu.

Dear Sir:—

Your letter of the 21st ultimo relating to an improved veterinary service in this Territory and asking for additional information on the subject has been received. In reply I beg to submit the following:—

The recommendation of the Territorial Veterinarian to provide veterinary service for the principal Islands of this Territory meets with the approval of this Board. There is, however, no money available wherewith the Board could pay even part of the salaries of the four veterinarians whom it is proposed to employ.

The principal aim of having skilled veterinarians stationed where they can reach any sugar plantation within a few hours after being notified, would be the suppression and eradication of glanders. This disease has, according to the observations of the Territorial Veterinarian during the past two years, caused more losses among plantation work stock than all other diseases combined. Five epidemics have occurred on five different plantations, (on Oahu, Maui, and Hawaii) resulting in the immediate loss of more than 50 work animals. At a conservative figure, this means a loss of $10,000 and with the present prices of mules the dead animals could not be replaced for less than $12,500.

In our opinion this great loss could have been minimized in case veterinarians had been available when the first suspicious

symptoms of the disease made their appearance. The Board is also of the opinion that, except for the arrival of the Territorial Veterinarian and for the measures taken by him in checking the disease, the losses would have been much greater.

Aside from glanders, horses and mules are subject to such a variety of diseases, most of which will yield to timely treatment, that the cost of maintaining a veterinarian within reasonable calling distance would seem an economic measure even if he succeeded in saving the life or prolonging the usefulness of but one mule for each plantation per annum.

In reply to your next question, I would say that the veterinarians under discussion would be appointed Deputy or Assistant Territorial Veterinarians by this Board, and would exercise the same authority and enjoy the same prerogatives as those vested in the Territorial Veterinarian. (Section 390C and 390D, Act 82, Session of 1905.)

In regard to the charges which these veterinarians would be allowed to make, the Board would suggest as follows:—

By consent of the Federal Bureau of Animal Industry all live stock intended for shipment to this Territory will in the future be inspected and tested, free of charge, and certificates issued to that effect by the federal inspector stationed in San Francisco. A new regulation will be promulgated by this Board permitting the landing of stock at any port of entry in this Territory when accompanied by such certificates. It will, however, be the duty of the veterinarians in question to meet consignments of live stock upon arrival, to inspect the same, and to examine the papers accompanying them. For this class of service no charge would be made.

In the case of the appearance of any contagious diseases among the work stock of any plantation, or among animals belonging to private parties, the veterinarian shall attend the same without charge for his services or time, but should be entitled to recover his actual expenses for traveling and subsistence from the party who sent for him. For instance, if a

plantation manager in the vicinity of Laupahoehoe should have his attention called to a suspicious case of glanders, belonging to a Japanese or Portuguese living in that neighborhood, and should request the veterinarian stationed in Hilo to come up and examine the animal, the veterinarian should be entitled to recover his actual expenses from the plantation in whose interest and at whose request the investigation had been made. A uniform scale of mileage should be agreed upon in advance and the charges fixed for consultation in all cases where the veterinarian is called to prescribe, treat, or operate on animals affected with surgical or medical diseases not of a contagious nature. If a difference of opinion should arise between the veterinarian and the party employing him as to the amount of compensation, the same should be referred to an official of the Sugar Planters' Association and the Territorial Veterinarian for adjustment.

In the opinion of the Board the $100 per month to be paid to each of the veterinarians should be considered more as an insurance premium on the work stock belonging to the plantations than as compensation for services actually rendered, except as stated above.

In regard to your next question it would seem obvious that in case the plantations and others contributing to the salaries of the veterinarians should be entitled to the services, free of charge, in any and all cases, there would be little prospect of the latter increasing their income above the $100 per month salary. In this connection, we would call your attention to the fact that the usual contract fee paid by plantations for veterinary service in these Islands averages $25 per month for each plantation, and as the sum required to secure the presence of the necessary number of veterinarians would only amount to $6 or $7 per month per plantation, it is not to be expected that the treatment of all cases should be included in this sum.

In the opinion of the Board the $400 required should be divided at the rate of 3 to 1 on the Sugar Planters' Association

and the Live Stock Association. The said Live Stock Association has practically become dissolved and it will be necessary to address a letter to each of the stock breeders in the Territory to ascertain how much they will contribute toward the salaries of one of the veterinarians. So far only Mr. A. W. Carter of the Parker Ranch has promised to pay $25 per month and it is believed that the remaining $75 will be subscribed. The ranch industries of the islands will, however, in the main be looked after by the central office in Honolulu, as has hitherto been the case, there being no acute contagious diseases of cattle and sheep known to exist in these islands.

In view of the fact that a veterinarian is located in Hilo who does contract work for a number of the plantations in that vicinity as far north as Laupahoehoe it would not seem necessary to station another man there unless the resident veterinarian should find it incompatible with his work to assume the duties of deputy or assistant territorial veterinarian.

The islands of Kauai and Maui can each be looked after by one veterinarian, while two hardly seem sufficient for Hawaii on account of the great distances. A veterinarian stationed at Kamuela (Waimea) would have to look after Kohala, Waimea and Hamakua as far south as Paauhau landing, and Kona as far south as Huehue (Maguire's). The Hilo veterinarian should take all of Hilo district and north into Hamakua to and including Paauhau Plantation, as well as Puna to the South. This, however, would leave the principal part of Kona as well as the entire Kau district unprotected. Whether it would be necessary to provide for one more veterinarian to be stationed at Waiohinu or at the Hutchinson or Pahala Plantation is yet to be decided. Either of these two plantations as well as the Kapapala Ranch can, however, be reached in one day from Hilo, and it would be a question if a veterinarian would be willing to locate in Kau, even with a subsidy of $100 per month unless he could get contracts with the plantations mentioned. In the same way the veterinarian stationed at Waimea can when

necessity arises extend his field of operations as far south into Kona as required.

In a general way it should be the duty of the veterinarians in question to make a complete round of their districts as often as possible, notifying all managers beforehand of the time of arrival so that animals to be inspected or treated may be kept home. In the same way, if called to any particular place, he should notify managers of plantations on his way or beyond his destination so that they may obtain his services without paying mileage. The veterinarians should when so requested provide managers with a list of the most necessary remedies to be kept on hand, so that at least preliminary treatment can be instituted by telephone.

The veterinarians shall, when so directed by the proper official of the Sugar Planters' Association and through the Territorial Veterinarian, furnish a complete report on the physical and sanitary conditions of work stock, stables and premises of any plantation. This report shall be mailed direct to the said official of the Planters' Association and by him delivered to the applicant for same.

Whenever glanders or any other contagious disease shall make its appearance it shall be the duty of the said veterinarians to immediately report so to the Territorial Veterinarian together with all details as to measures taken to prevent further spread of the disease. The Territorial Veterinarian will decide whether a personal investigation by him is required or send instructions for the veterinarians in question to be guided by. The traveling expenses as well as the services of the Territorial Veterinarian are paid from the appropriation for the Board of Agriculture and Forestry.

In case the Board of Directors of the Hawaiian Sugar Planters' Association should decide to appropriate the required $300 per month, this Board will take steps at once to secure the services of suitable men, either through the U. S. Civil Service Commission or through the U. S. Bureau of Animal Industry.

As the veterinarians in question will receive their authority from this Board it would seem to us most appropriate if the funds for their payment be turned over to the Board for disbursement.

In conclusion the Board of Commissioners of Agriculture and Forestry would be pleased to receive suggestions from the Directors of the Hawaiian Sugar Planters' Association relative to the subject under discussion.

Very respectfully,

BOARD OF COMMISSIONERS OF
AGRICULTURE AND FORESTRY.
(Signed) C. S. HOLLOWAY,
President and Executive Officer.

Honolulu, Hawaii, Dec. 18, 1907.

Mr. H. M. Von Holt,
President Hawaiian Livestock Breeders' Assn.,
Honolulu.

Dear Sir:—

Pursuant to a resolution passed by the Board of Commissioners of Agriculture and Forestry at the last meeting on December 11th, I enclose herewith copies of the correspondence which has taken place between the Hawaiian Sugar Planters' Association and this Board relative to an improved veterinary inspection and sanitary service for this Territory.

The Board would respectfully ask you to carefully consider the contents of this correspondence and to take the necessary steps to ascertain to what extent cooperation and financial support can be expected from your Association or from its individual members.

The Board would also ask for an expression of your opinion of the plan as outlined in the said correspondence and for any advice or suggestions which you may wish to make as the representative of the Live Stock interests of this Territory, as well as in your capacity of superintendent of the ranches of the Oahu Land & Railway Company.

Trusting that you will give this matter your early attention, we beg to remain

Very respectfully,

BOARD OF COMMISSIONERS OF
AGRICULTURE AND FORESTRY.
(Signed) C. S. HOLLOWAY,
President and Executive Officer.

No further action on the subject was taken during the year of 1907. It may, however, be added that in the beginning of 1908 Dr. H. B. Elliot of Hilo, Hawaii, was appointed to the position of Deputy Territorial Veterinarian for the district of North Hilo, South Hilo, Puna and Kau, the plantations and ranches in the said district agreeing to pay him a salary for official work, aggregating $100 per month.

Up to the present writing no action toward the appointment of official veterinarians has been taken by the plantations and ranches on the northern and western part of Hawaii or on the Island of Kauai. On the Island of Maui however, an association has been organized for the equable adjustment of taxation of plantations and ranches as to their respective shares in the payment of the salary of a veterinarian. It is therefore expected that the Maui district will be provided with a Deputy Territorial Veterinarian before long.

THE PATHOLOGICAL LABORATORY.

The last legislature made appropriation for the construction and equipment of a laboratory for the pathological and bacteriological investigation of animal diseases and for the microscopic examination, for diagnostic purposes, of pathological specimens from diseased or dead animals.

Immediately after the beginning of the last fiscal year plans and specifications were prepared and by the middle of September the building was finished and accepted. The equipment, however, which had been ordered from the East, was somewhat

INTERIOR OF NEW RESEARCH LABRATORY.

delayed in getting here, but as it now stands the laboratory is practically complete as far as pathological investigations are concerned. The bacteriological equipment has only been ordered, as its importance was considered secondary and to a certain extent dependent upon the securing of a scientific laboratory assistant.

The building, which stands in the grounds of the Government Nursery, just Ewa of the main building of the Board of Agriculture and Forestry, is 20 by 20 feet and externally conforms in appearance to this building.

The inside consists of one large room, very light and airy, from which is paneled off a small incubator room.

The entire north wall consists of windows, at the foot of which is a work bench, stretching across the full width of the room and supported in the middle and at the ends by drawer cabinets. On the west wall is a lead-topped cupboard cabinet, surmounted by a galvanized iron hood, supported on the sides by window frames, and provided with gas jets for the preparation of culture media and chemical solutions, the fumes of which are carried off through the hood. On the same wall is a sink with draining boards, and a smaller work bench surmounted by a glass door cabinet. In the middle of the room is a large work table and along the remaining walls are cupboards, cabinets for glassware and chemicals, as well as the office desks of the Territorial Veterinarian and his assistant.

THE LIBRARY OF THE DIVISION OF ANIMAL INDUSTRY.

The following new books pertaining to veterinary science in general, as well as to pathology, bacteriology and laboratory technique, have been received in the course of the year:

Anaemia, and Some of the Diseases of the Blood-forming Organs and Ductless Glands.	—Byron Bramwell.	1900
Animal Dentistry and Diseases of the Mouth.	—Louis A. Merrillat.	1905
(The) Animal Parasites of Man	—Max Braun, M.D.	1906
Applied Bacteriology. (3d ed.)	—Cresacre G. Moor and Richard Tanner Hewlett.	1906
Atlas and Essentials of Pathological Anatomy. Vols. I and II.	—Dr. O. Bollinger.	1898
Atlas of the Anatomy of the Horse and of Other Domestic Animals. Vol. I Plates. Vol. II Explanatory Text.	—Prof. William Ellenberger.	1905
Bacteriology of Milk.	—Harold Swithinbank and Geo. E. Newman.	1903
Bilharziosis.	—Frank Cole Madden.	1907
Diseases of Cattle, Sheep, Goats and Swine.	—John A. W. Dollar and G. Mossu.	1905
Diseases of the Horse's Foot.	—H. Caulton Reeks.	1906
Diseases of the Mammary Gland of the Domestic Animals.	—P. LeBlanc.	1904
Essentials of Physiology for Veterinary Students. (2d ed.)	—D. Noel Paton.	1908
(The) Essential Similarity of Innocent and Malignant Tumors.	—Chas. W. Cathcart.	1907
Examination of the Urine of the Horse and Man.	—Pierre A. Fish.	1906
Experiments on Animals. (3d ed.)	—Stephen Paget.	1907
Farm Buildings. (rev. ed.)	—Sanders Publishing Co.	1907
(A) Guide to the Clinical Examination of the Blood for Diagnostic Purposes. (5th ed.)	—Richard C. Cabot.	1904
Handbook of Meat Inspection. (3d ed.) (Translated by Earley Vernon Wilcox.)	—Dr. Robert Ostertag.	1907
(A) Handbook of Pathological Anatomy and Histology. (8th ed.)	—Francis Delafield and T. Mitchell Prudden.	1907
(The) Horse Book.	—J. H. S. Johnstone.	1908

Immunity: Protective Inoculations in Infectious Diseases and Serum-Therapy. —Geo. M. Sternberg. 1895

(A) Manual of Bacteriological Technique and Special Bacteriology. (2d ed.) —Thomas Bowhil. 1902

(A) Manual of Clinical Laboratory Methods. —J. B. Nichols. 1902

(A) Manual of Veterinary Hygiene. —Capt. F. Smith.

Milk Hygiene. (Prof. C. O. Jensen of Copenhagen.) —Leonard Pearson. 1907

(The) Modern Packing House. —F. W. Wilder.

Notes on Blood-Serum Therapy, Preventive Inoculation and Toxins and Serum Diagnosis. —Walter Howett. 1907

(The) Pathology and Differential Diagnosis of Infective Diseases of Animals. (2d ed.) —Prof. V. A. Moore. 1906

Points of the Horse. (3d ed.) —Capt. M. Horace Hayes. 1904

(A) Practical Laboratory Course in Medical Chemistry. —Jno. C. Draper. 1882

Practice of Veterinary Surgery. Vol. I Operative Technique. —J. A. W. Dollar. 1906

Protozoa and Disease. —J. Jackson Clarke. 1903

Regional Surgery. —Prof. J. Moller and J. A. W. Dollar. 1907

(The) Serum Diagnosis of Diseases. —Richard C. Cabot. 1899

Sheep Farming in America. (rev. ed.) —Joseph E. Wing. 1908

Short-Horn Cattle. (2d ed.) —Alvin H. Sanders. 1901

Surgical Diseases and Surgery of the Dog. —Cecil French. 1906

Surgical Diseases of the Dog and Cat. (2d ed.) —F. T. G. Hobday. 1906

(A) Text-Book of Anatomy. (2d ed.) —D. J. Cunningham. 1907

(A) Text-Book of Bacteriology. (2d ed.) —Geo. M. Sternberg. 1901

Text-Book of General Pathology. —Ernst Zeigler. 1903

(A) Text-Book of Normal Histology. (ed ed.) —F. R. Bailey, M.D. 1907

(A) Text-Book of Special Pathological Anatomy. Sec. I-VIII 1898
Sec. IX-XV 1897
—Ernst Zeigler.
(Translated and edited by Donald Macalister and Henry W. Cattell.)

Text-Book of Veterinary Medicine. Vol. I, II, III. 1905
Vol. IV (2d rev. ed.) 1906
Vol. V. 1903
—James Law.

(A) Treatise on Epizootic Lymphangitis. —Capt. W. A. Pallin. 1905

Treatise on Parasites and Parasitic Diseases of Domesticated Animals. —L. G. Neuman. 1906
(The) Treatment of Wounds. —L. S. Pilcher. 1899
Tropical Diseases. (4th ed.) —Patrick Manson. 1907
Veterinary Doses and Prescription Writing. (3d ed.) —Dr. P. A. Fish. 1908
Veterinary Studies for Agricultural Students. —H. M. Reynolds. 1903
Die Hufkrankheiten des Pferdes. —Prof. F. Gutenacker. 1901
Die Rotsbekampfung und die Maleinprobe eim Pferde. —Prof. Dr. M. Schlegel. 1905
Grundrisz der Antiseptischen Wundbehandlung. —Prof. H. Frick. 1890
Grundrisz der Milchkunde und Milchhygiene. —Prof. C. O. Jensen. 1903
Jahresbericht uber die Ergebnisse der Immunitatsforschung. I and II Band. —Dr. Wolfgang Weichardt. 1906-08
Jahresbericht uber die Leistungen auf dem Gebiete der Veterinar-Medicin, Register 1-15, 1881-1895. —Dr. Ellenberger und Dr. Schultz. 1897
Jahresbericht uber die Leistungen auf dem Gebeite der Veterinar-Medicin. —Dr. Ellenberger und Dr. Schultz.

Volume 1-5	1881-1885	1882
" 6-9	1886-1889	1887
" 10-13	1890-1893	1891
" 14-17	1894-1897	1895
" 18-20	1898-1900	1899
" 21-23	1901-1903	1902
" 24-25	1904-1905	1905

Die Animale Impfanstalt. —F. Roepke, Kreistierarzt. 1890
Lehrbuch der Arzneimittellehre fur Tierarzte. —Prof. Dr. E. Frohner. 1906
Lehrbuch der Arzneiverordnungslehre. —Prof. E. Frohner. 1904
Lehrbuch der Allgemeinen Therapie. —Prof. Dr. E. Frohner. 1906
Lehrbuch der Allgemeinen Pathologie fur Tierarzte und Studierende. —Prof. Dr. Th. Kitt. 1895
Lehrbuch der Augenheilkunde. —Prof. Dr. H. Moller. 1898
Lehrbuch der Allgemeinen Tierzucht. —Medizinalrat Prof. Dr. Pusch. 1904
Lehrbuch der Vergleichenden Anatomie der Haustiere. I Band. —Prof. Dr. Med. M. Sussdorf. 1895

Lehrbuch der Pathologische Anatomie der Haustiere. I, II Band. —Prof. Dr. Th. Kitt. 1905-06

Lehrbuch der Spezielle Pathologie und Therapie der Haustiere. I, II Band. —Dr. Franz Friedberger und Prof. E. Frohner. 1897

Les Maladies Microbiennes des Animaux. Tome I, II. —Ed. Nocard et E. Leclainche. 1905

Spezielle Operationslehre des Pferdes.

Tierphysiologisches Praktikum. —Prof. Dr. J. Vennerholm. 1907

—E. H. Stein. 1903

INDEX

	Page
Acacia	54
Acetate of lead	158
Actinomycosis	100, 125, 126
Acute Infectious Keratitis	145
Acute Infectious Conjunctivitis	145
Adams, Andrew	34, 40, 65, 69
Administration, Territorial	12
Agricultural Experiment Station	119
Agrotis	92
Ahrens, A.	30, 66, 71
Alala	61
Albizzia Moluccana	32
Aleyrodidae	2
Algaroba	23, 34
Alligator Pear	32
American Hawaiian Mahogany Co.	41
American Sugar Company's Ranch	31
Amygdalina Eucalyptus	35
Anahola	64, 68
Anderson, W. A.	55
Angus, Cattle	120
Aphides	96
Aphis parasite, Cal.	85
Apple pests	81
Arbor Day	44, 49
Arizona Dung-Fly Parasite	86, 88
Arnold Arboretum	56
Asia	83
Atkinson, A. L. C.	11
Auckland	120, 121, 123
Austin, C. J.	55, 66
Australia	33, 35
Automeris	92
Avocado	86
Bailey, C. H.	69
Bacilli, Spore Bearing	183
Bacteria	182
Baker, Dr. G. S.	112
Baldwin, H. A.	66, 70
Baldwin, H. P.	66, 70
Barkhausen, L.	66, 70
Bee disease	1
Bees	1
Beneficial insects	3
Berkshires	117
Berlin	47
Big Head	123
Bird Law	61, 64
Bird, Rice	61
Bishop Estate	25, 28
Bishop Libert	52
Bishop Museum	173
Blackman, L. G.	2, 77
Black Chalcid Parasite	91
Black fungus	33
Black phoebe	173, 174
Black Wattle	52
Blissus leucopterus	96
Bluebird	173
Board of Live Stock Inspectors	136
Bombycid Larva	92
" Moth	93
Books in Library	74
Botanic Gardens	9, 47, 56
Botanical Laboratory	56
Botany	73, 74
Bot flies	175
Botryoides Eucalyptus	35, 36
Boxes, Insect	49
Brazil	48
Briton, Dr. N. S.	56
Broadbent, E.	64
Bryan, Wm. A.	174
Buchholtz Place	41
Bug, Torpedo	33
Buildings and Grounds	77
Bureau, Biological Survey	37
California	41
California Acadamy of Sciences	174
California	86, 92
" Orange Aphid	85
" Aphis Parasite	85
Calliphora dux	177, 178, 184
Campbell, G.	69
Campbell, Marston	48, 50, 78
Camphor	32
Cane Seedlings	82
Carabidae	172
Carter, A. W.	30, 66
Carter, G. R.	63
Canada	104, 161, 164
Canadian-Australian S. S. Line	122
Castilla	49, 55
Castilloa	51
Castle Estate	49
Castle, J. B.	41
Castle, W. R.	67
Casuarina	36
Catarrhal Inflammation of the Mouth	151
Catholic Mission Lands	52
Ceara Rubber	50, 51
Central American Rubber	49, 51
Ceylon	43, 49
Chalmers, J.	71
Chalcid Parasite, Black	91
Chalcid parasite	92, 93, 94
Chickens, Fancy	118
Chief Fire Warden	39, 46, 68, 76
China	82
Chinch Bug	96
Chondestes	173
Chrysopidae	96
Chronic Lead Poisoning	158
Clerk of Board	77
Clevedon	120

	Page
Clubs, Improvement	49
Cobb, Dr. N. A.	28
Coconut	44
Coconut Industry	9
Coconut Plantation	44
Coccinella sanguinea	96
Coccinellidae	96
Coccus mangiferae	83
Coffee	33
Commissioner of Public Works	20
Committee, Forestry	27
Compsomyia macellaria	178
Comptroller U. S. Treasury	24
Committee, Animal Industry	188
Contagious disease .....100, ... 111, 125, 136, 140,	146
Conant, E. E.	30
Coney Estate	37
Congressional Seed	48, 76
Contracts	6
Conradt, C. C.	65, 70
Cooke, J. P.	188
Coquillett, D. W.	178
Corymbosa, Eucalyptus	35
Corynocalyx, Eucalyptus	35
Craw, Alexander	3
Creosote	36
Crow, Native	61
Cyrtodisca major	93, 94
Deputy Fire Warden	68
" Sheriff	39
Denver 169,	170
Diatraea saccharalis	89
Dillingham, W. F. 33, 65,	69
Disease, Fungus	28
Disease, Mouth	151
Diseases, Plant	79
" Unknown tree	35
Diseased Sugar Cane	81
Distemper, Eye	145
Distribution, Yearbooks	76
" Seeds	76
District Foresters..29, 30, 31, 37, 64,	66
District Fire Wardens, 10, 38, 39, 49,	68
District of Ewa 53, 65,	69
" " Halelea	64, 68
" " Hamakua	66, 71
" " Hamakualoa	66, 70
" " Hamakuapoko	66, 70
" " Hana	66, 71
" " Hilo 66, 67,	72
" " Honuaula and Kahikinui	71
" " Kaanapali	70
" " Kau	67, 72
" " Kipahulu	71
" " Kohala	71
" " Koloa	68
" " Koolau .. 29, 64, 66, 68,	70
" " Koolauloa	65, 69
" " Koolaupoko	65, 69
" " Koolau and Puna	68
" " Kona, 25, 64, 65, 67, 68,	69
" " Kula, Honuaula & Kaupo	66
" " Kula and Kaupo	71
" " Lahaina	66, 70
" " Makawao	66
" " Na Pali	64, 69
" " North Kohala	66
" " North Kona	67

	Page
" " Puna 51, 64, 67,	68
" " South Kohala ..66, 67,	71
" " South Kona	67
" " Waimea	64, 69
" " Wailuku	66, 70
" " Wailanae 65, 69,	70
" " Waialua 39, 65,	70
Domkowitz, R. von S.	55, 72
Dowsett Company	53
Dryinid Parasites	95
Duncan, R. A.	157
East Indies	91
Education in Forestry	26
Edwards, E. H.	30
Ehrhorn, E. M.	85
Eleele	30
Elliot, Dr. H. B. 136,	196
English Blue Bottle fly	178
Entomologist Assistant	3
Entomological Society	75
Entomologists	4
" Consulting	3
Entomology 73, 74,	77
Epsom Salts 157,	159
Esophagus	175
Eucalyptus,	23
European or house Sparrow	61
Ewa	197
Ewart, G. R.	50
Exchange List	56
Exhibit Room	75
Expenses, Current 6, 8,	10
Experiment Station	47
" " state	73
Extention Forest 22, 23,	24
Extermination of Goats	21
Eye Disease	145
Fairchild, Geo. H. 31, 64,	68
Farcy	134
Faulkner, E. O.	40
Federal Bureau of Animal Industry 112, 126,	191
Federal Department of Agriculture	99
Fencing	21
Fetter, Capt.	39
Fiber Co., Hawaiian	52
Fiji	94
Finch, The house	61
Fires, Forest	39
Fire Danger, Forest	38
Fires, Record of	39
Fire Service, Forest	38
" " District 10, 38,	68
" Warden at Large	70
Fitzgerald, Dr. 131,	133
Fletcher, Mr.	161
Forbes, D.	30
Foreign Fruits	83
Forester and Agriculturist, 2, 19, 27,	77
Forest, Commercial	19
Foresters, District	10
Forest, Eucalyptus	72
" Extention 22, 23,	24
" Fire Service	38
" Hawaiian 9, 11, 13,	19
" Management	25
" Nurseryman 47, 54, 76,	78
" Park	38
" Plantations, Nuuanu	38

	Page
Forest Planting	31
" Protection	19
" Rangers, 3, 10, 20, 38, 39, 45, 72	
" Reserves 1, 2, 10, 14, 15, 16, 17, 22, 45, 76	
" Reserves Hana	18
" " Hawaiian	21
" " Kauai	22
" " Kohala mountain	12
" " Makawao	12
" " Policy	18
" " Waiaha Spring	12
" " West Maui	12
" Service, Territorial	21
" Work	25
" Committee	27, 76
" in General	40
Franceschi, Dr. F.	56
Freycinetia	28
Fruit Flies	83
Fulgorid	95, 96
Fulgorid Leaf Hopper	96
Fumigation, Plant	83
Fungus	29
Fungus, Black	33
" Disease	28
" Root	33
Gama grass	91
Garlic, Infested	80
Gay, Mr.	12
" Charles	65, 70
" Francis	55, 64, 69
Germany	47
German Coach Stallions	115
General Work	83
Gibb, James	71
Gibson, T. H.	51
Giffard, W. M.	39, 69
Glanders 100, 102, 108, 110, 114, 128, 133, 141, 190, 194	
Glaubers Salts	159
Glenwood	41
Goodale, Dr. G. L.	56
" W. W.	30, 52, 65
Goose, Hawaiian	37
Gastroenteritis	157
Government 18, 21, 38	
" Forest Lands	42
" Nursery 3, 23, 24, 47, 77, 78	
" Property	78
Grape Vine Cuttings etc.	82
Gray, Robt. M.	56
Greenwell Estate	26
Grevillea Robusta	32
Ground Towhee	173
Grove Farm Plantation	30, 64
Growing and Distribution of Plants	48
Guava, Strawberry	32
Gunil, Eucalyptus	35
Gypsy & Brown-Tail Moths	166
Haematobia serrata	87
Hakalau Plantation Co.	31, 36
Halawa	65, 70
Halcakala Ranch	31, 35
Halelea, District of	64
Hallsidota	93
Hamakua	30, 31
Hamakua and Hana District	89
Hamakua	193
Hamakua Mill Co.	31
Hamakua, West	30
Hamakualoa, District of	66
Hamakuapoko, District of	66
Hanapepe Valley	64, 69
Hannestad, Miss Katherine	77
Hau	34
Haughs, D. 10, 22, 24, 54, 68, 78	
Hawaiiana	74
Hawaiian Agricultural Co.	31
" Entomological Society	75
" Development Co.	37, 42
" Fiber Co.	52
" Forest	42
" Goose	37, 61
" Mahogany Co. 9, 25, 37, 40, 41	
" Pineapple Co.	33
" Poultry Association	75
" Public School	44
" Rubber Growers	43
Haw'n. Sugar Planters' Association 186, 188, 192, 194	
Hawaiian Stock	136
Hawaiian Sheep Maggot-fly 160, 177, 178	
Hawaiian Cattle Raisers Assn. 186, 188	
Haw'n. Stock Breeders' Association	159
Hawaiian and Australian flies	178
Hawaii Agricultural Experiment Station	159
Heeia	65, 69
Heel-Fly	175
Hematuria 100, 124	
Henshaw, Prof. 171, 172, 173, 181, 182	
Herd, John 32, 65, 69	
Herefords 116, 120, 146	
Herrera, Prof.	93, 94
Hevea	67
Hewitt, G. C.	67
High Sheriff	37
Hilo	41
Hilo 101, 102, 115, 133, 136, 137, 186, 192, 193, 196	
Hilo, District	19, 71
Hilo Jail	39
Hilo, North	36
Hind, R. H.	55
Hippodamia convovregens	96
Holloway, C. S. 50, 78, 121, 188, 195, 196	
Holstein, H. L.	55
Holstein Bulls	120
Honahona	152
Honey	1
Honolulu Improvement Advisory Board	75
Honomu	31, 36
Honomu Sugar Co.	31
Honouliuli Ranch	31
Hookena	72
Hoopuloa	41
Horner, Albert	71
Horn-fly 160, 164, 170, 179	
Horned-Lark 173, 174	
Hosmer, R. S. 3, 10, 46, 47, 68, 78	
House finch, The	61
Howard, Dr. L. O.	91

	Page
Howard, Mr.	166
Howell, H.	55
Hudson, C. W.	55, 68
Huehue	193
Hutchinson or Pahala Plantation	193
Hyperaspis 8-notata	86, 88
Hypoderma bovis	175
Ieie vine	28
Ii Estate	33
Improvement Advisory Board	75
" Clubs	49
Indian Mango Trees	83
Industrial School, Waialee	51
Industry Coconut	9
" Lumber	40
Infested Garlic	80
Infectious disease	100
Infectious Ophthalmia	145
Information Bureau	24
Insects Affecting Live Stock	159
Insects, Beneficial	85
Insect Boxes	49
Insect Life	91
" pest of live Stock	159
Insect Investigations	89
Inspection of Importations	79
Inspector, Plant Quarantine	81
Inspection Service	114
Ironwoods	23, 31, 36
Isenberg, P. R.	65
Italy	82
Iten, H.	55
Japan	79
Japanese Cedar	23
" Plums	32
Japanese Rice	79
Jassid Leaf Hopper	93, 95
Jonacatepec, Mexico	93
Jordan, G. A.	87
Judd Land	72
Kaanapali, District	70
Kaauhuhu	71
Kaaupuna	72
Kaawaloa	72
Kaawaloa Point	42
Kahalulu	67, 72
Kahuku	31
" Plantation Co.	31, 34
" Railroad Co.	36
Kailua	65, 69
Kalanianaole, J. K.	48, 76
Kalihi Valley	52
Kamalle Tract	57
Kamuela	131, 186, 193
Kaohe	67
Kapapala Ranch	193
Kapihe, D.	10, 54, 72
Kau	19, 25, 67
Kauai 11, 12, 22, 29, 30, 31, 32, 44, 64, 68	
Kauaikanana Valley	64, 69
Kaupo	53
Kawaihae	1, 71
Kawailoa Tract	52
Kay, T. S.	29
Keahealaka Tract	57
Kealea	30
Keauhou	25
Keawi	32
Kellogg, L. T.	188
Kentucky	185
Kikala	67, 72
Kipahulu, District of	71
Kirkaldy, Mr. G. W.	85
Knudsen, A. F.	64, 69
" Brothers	12
" Estate	12
Koa	31, 34, 41, 42, 54
Koebele, A.	3, 33
Kohala	31
" District of	71, 72
" North	30, 36
" South	30
" Sugar Co.	31, 36
Koloa	30
" District	32
" Sugar Co.	30, 32
Kona	12, 19, 26, 32, 42
" District	42, 72
" forest	25, 42, 43
Konahuanui Mountain Range	72
Kona, North	12, 37
" South	30
Kona storm	28
Koolau	28, 35
" District	28
Koolauloa	34, 40, 65
Koolauloa, District of	65
Koolaupoko	32, 65
Koolau Range	33
" Section	28
Kotinsky, Jacob	73
Kukalau	71
Kukui	32, 54
Kawaihae	132
Kukuihaele Plantation	132
Laboratory, Pathological	196
Ladybirds	86, 88
Lahaina, District of	66
Lanai	65, 70
" Case	38
" Exchange	38
Lands, Government	11, 12, 13, 16
Lantana	33
Lantana insects	88, 93
Lark Finch	173, 174
Laryngitis	100, 141, 144
Laupahoehoe	192, 193
Law, Prof.	143, 152, 159
Lead Poisoning	153, 154. 157
Leaf Hoppers	93, 94
Lee, P.	55
Legislature	1, 3, 4, 5, 21, 40, 61, 78
Letters	76
Leucoxylon, Eucalyptus	35
Librarian	76, 78
Librarian, Report	73
Library	73, 74
Library List	199
Lihue	186, 188
" Plantation Co.	30
Lita solanella	80
Live Stock Association	193
Local Inspection Work	83
Loebenstein, D.	55
Loomis, L. M.	174
Lower Pouhala	52
Lucilia sericata	178
Lumber Industry	40
Lumber, Koa	41

Page

Lumpy Jaw 125, 126, 127
Lupin Seed 82
Lydgate, Reverend J. M. 32, 64, 68
Lyman, H. 55
" L. C. 55
Lyon, Dr. H. L. 24

Maggot-fly 180, 181
Maguire, J. A. 37, 67, 72
Maile Pilau 54
Makahanaloa 66, 71, 72
Makapuu Point 65, 69
Makawao 35
Makee Sugar Co. 30, 31
Makiki 72
" Reservoir 72
" Valley 48
Malay Peninsula 43
Mallein Test 102, 103, 114, 128, 129, 134
Mango Scale 83
Mango, Trees 32
Manihot 47, 50, 56
Manoa Valley 65, 72
Massachusetts 161
Matthias, Brother 55
Maui . . 9, 12, 18, 28, 31, 35, 43, 53, 66, 70
" Agricultural Co. 31
" Rubber Plantations 43
Maunawili Ranch 31, 32, 49
McBryde, Walter D. 31, 55, 64
" Sugar Co. 30, 32
McCandless, L. L. 65
McDougall, G. W. 55
McVeigh, J. 55
Mead, R. D. 190
Meadow Lark 173
Megilla maculata 96
Metrosideros 28
Mexico 86, 89, 90, 91, 93, 96
" City 92, 96
Mexican Leaf Hopper 95
" Sugar Hopper 94
Meyers, F. 70
Ministry of the Interior 137
Mitchell, J. D. 166, 182
Mites 82
Moir, John T. 72
Molokai 31, 65, 70
Molokai Ranch 184
Moluccana, Albizzia 32
Monkey Pods 32
Monsarrat, J. 67
Montana 114, 169
Mongoose 173
Moore, G. H. 39, 69
Mothborer 89, 90, 91, 93
Moth, Potato 80
Mount Haleakala 12
Munro, J. 55, 65, 70
Munro, G. C. 120, 121, 122
Murdock, D. B. 53
Museum, National 73
Meyers, J. R. 64, 68
Mymarid Parasites 94, 96
Mynah 61

Na Pali 11
" " Kona Forest Reserve, 11, 12
Nahiku 42
National Forest 21
" Museum 73

Page

Native Crow 61
" Hawaiian Trees 45
Needs in Forest Work 20
Nene 37, 61
Nevada 114
New England 166
New Zealand 117, 118, 120, 121, 122, 123
Noctuid Caterpillars 95
" Larvae 92
" Moth 92
Norgaard, Dr. V. A. .....
...4, 73, 99, 101, 160, 178, 183, 188
Normal School 74
Nowell, A. M. 29
Nursery, The 47, 50, 78
Nurseryman, Forest 10, 22, 47
Nuuanu Forest Plantation 38
" Station 47, 54
" Forest 37
" Valley 38, 39

Oahu 12, 29, 30, 31, 32, 33,
.... 34, 38, 39, 40, 44, 51, 65, 69, 72
" Railway & Land Co. 33
Oceanic S. S. Co. 122
Oedema 143
Ogg, William G. 72
Ohia 42, 54
" Lehua trees 28
" Timber 41
Olaa Plantation 41
Olives 32
Olohena 68
Ontario 161
Oregon 114
Osteomalacia 124
Osteoporosis 100, 123
Ostertag, Prof. 126

Paauhau 71
" Sugar Co. 31
Paauilo 31
Pahala 31
Pahia, Frank 69
Pahoa 37
Paia 31
Palama 135
" Fire Station 135
Palolo Valley 69
Paniculata, Eucalyptus 35
Para grass 95
Para Rubber Trees 49, 51
Paris, J. D. 55, 67, 72
Parks 47, 49
Parasite Skin Disease 113
Passerine 61, 62
Pathology, Division of Vegetable 28, 29
Pathologist, Vegetable 29
Pauoa Valley 69, 72
Paxton, E. E. 53
Pay Rolls 6, 10
Pear, Alligator 31, 33
Pearl City 87
Pepeekeo Sugar Co. 31, 36
Percheron 115
Perkins, Mr. 89
Personnel 77
Petaluma 41
Peterson, Miss Melika 77
Pests, Apple 81
Philippine Publications 74

	Page
Phylloxera	82
Piihonua	19, 20
Pilau, Maile	54
Pipilo crissalis	173, 174
Pipunculus	95
Plantations	29
Planting Plans	76
Plantation, Coconut	44
" Rubber	9
" Sugar	30
Planter's Experiment Station	81, 82
Plant Lice	92
" Pathologist	81
" Quarantine Inspector	81
Plumbism	153
Pogue, W. F.	28, 29, 30, 53, 66, 70
Police Officers	37, 64
Polyanthemos, Eucalyptus	35
Polynesia	83
Poomau Valley	64, 69
Portuguese	192
Potassium Iodide	157
Potatoes, Irish	35
Potato Moth	80
" Scab	80
Pouhala, Lower	52
Poultry Association, Hawaiian	75
Pratt, Mr.	166
Priessnitz poultice	144
Pseudococcus nipae	86
Publications	2
Public Buildings	78
" Works Department	78
" Works, Superintendent of	38
Pukoo	65, 70
Pulvinaria psidii	86
Puna District	41, 72
"	19, 31, 37, 39, 41, 42
" Sugar Co.	37, 51
Punaluu	67, 72
Puunene	31
Quebec	161
Railroad ties, Ohia	9, 40
Ranches	31
Ranger, The	54
Raymond, Dr. J. H.	66, 71
Razor Back	157
Rebate on Post Office Box	49
Red Lead	156
Red Water	100, 124
Redwood Curbing	50
Reduviid Bug	95
Reference Books	74
Report, Assistant Entomologist	83
Report of Commissioners	1
Reports of District Foresters	30
" " Librarian	73
" " Supt. of Forestry	9
" Supt. Entomology	79
Reserve Established	11
" Projected	12
Revised Laws of Hawaii	18
Rhodes, H. J.	69
Rice, Japanese	79
Ritchie, Mr. J. D.	120, 121
Robinson, Mr.	12
Robusta, Eucalyptus	33
Robusta, Grevillea	32
Rocky Mountains	161
Root fungus	33
Ross, J. M.	36, 66, 71
Rostrata, Eucalyptus	33, 35
Rubber	9, 32, 37, 43, 49, 50, 51
Rubber Seed	32
Rudis, Eucalyptus	35, 36
Salaries	6, 10
Sanborn, W. F.	68
Santa Fe Railway	9, 40
San Francisco	41, 80, 81, 102, 103, 104, 105, 111, 112, 117, 122, 191
San Jose Scale	81
Scab, Potato	80
School, Normal	7, 14
Scientific Institute, Pacific	174
Scott, Frank	29
Scott, J. A.	39, 67, 72
Screw Worm fly	178
" " Maggots	179
Scymnus	96
Seabury, Dr. G. T.	167
Searle, R. C.	55, 70
Secretary of Agriculture	111, 120
Secretary of Interior	27
Seed and Plant Introduction	23
Septicemia	180
Sheep scab	110, 160, 179
" Maggot-fly	172
Sheriff	51
Short-horns	116, 120
Shropshires	117, 120
Siderophoia, Eucalyptus	35
Silk Oak	23
Smithsonian Institution	73
Snow, T.	55
Sonora	91
Sore Eyes	146
" Throat	141
South Hilo	138, 196
South Kohala	30
" Kona	30, 41
" Seas	44
Sparrow, European or house	61
Special Agent	43
" Police Officer	37, 64
Special Report, Cattle Diseases	125
Spencer, S. M.	71
Sphingolabis taeniata	95
State Experiment Station	73
State Game Commissioners, Cal.	173
Statistics Forest Reserves	13
Stock Breeders' Association	169, 178
Stockholm Tar	176, 180
Stomatitis	151, 152
Stomoxys calcitrans	87
Strawberry, Guava	32
Sugar-Cane, Diseased	81
" " Hopper, Mexican	90
Sugar Plantation Co.	30, 40
Superintendent, Animal Industry	186
Superintendent of Forestry	2, 10, 19, 20, 25, 27, 28, 46, 47, 68, 76
Superintendent of Public Works	38, 48, 50, 78
Supervisors (of Kauai)	22
Suva	122
Sydney	80
Syrphidae	96

Page

Tachina 92
Tantalus Forest 37, 38, 47, 54
" Heights 38, 39
" " District 10
Tapping Test 43
Templeton, W. M. 70
Territorial Administration 12
Territorial Board of Agriculture 121
Territorial Board of Health...129, 157
" Delegate 77
" Government 26, 40, 42
" Legislature 45
" Police Officers 37
" Veterinarian 4
Territorial Veterinarian Assistant 129, 130
Territorial Veterinarian and Deputy 134, 136, 186, 187, 196
Texas 161, 166, 169, 182, 183
" Cattle ranges 147
Thurston, L. A. 27
Tingid Bug 96
Torpedo bug 33
Tortricid moth 93
Treasurer of the Territory..... 49
Trees, Ironwood 31, 32
" Koa 31, 34
Tree planting 22, 30, 36
Trees, Rubber 6, 32
Treleasc, Dr. Wm. 56
Trichogramma pretiosa 91
Tripascum dactyloides 91
Trustees B. P. Bishop Estate... 25
Tuberculin Test 106, 114
Tuberculosis 100, 102, 105, 109, 114
Turkey Buzzards 171, 181, 182

U. S. Bureau of Animal Industry 109, 145, 167, 185, 194
U. S. Bureau of Entomology... 161
" " Civil Service Com. 194
" " Dept. of Agriculture.....121, 125
U. S. Forest Service 24, 45

Vancouver 118
Van Dine, D. L. 159, 165, 166, 171, 172, 173, 181, 182
Vegetable Pathologist 29
" Seed, Congressional 48
Veterinarian 5
Veterinarian, Territorial 4
Veterinary Division 121

Page

Visitors 75
Volcano House 41
Von S. Domkowitz, R. 30, 67
Von Tempsky, L. 35, 66, 71

Wahiawa 52
" Water Co. 52
Waiakea 39
Waialae, Improvement Club.... 75
Waialee Industrial School..... 57
Walalua 29, 30
" District of 39
" Plantation 52
Waianae, District of 65
Waianae Mountains 12, 34, 69, 70
" Range 33
" Uka 53
Waikiki 39
Wailua 64, 68
Waipio 33
Waipio District 133
" Valley 131, 132, 133
Wailuku 186, 188
" District 66
" River 20
" Sugar Co. 31
Waimanu Valley 66
Waimea 11
Wainiha Valley 68
Waimea 193
Wandering Jew 152
Warble-fly 160, 175
Warden, Fire 70
Water 19
Waterhouse, F. T. P. 43
Water Co., Wahiawa 52, 53
Watt, G. C. 30, 36, 66, 71
" J. 37, 67, 72
Wattle, Black 52
Weber, F. 64, 68
Webster, F. L. 55
Weedon, W. C. 65
Weinrich, W. 53
Wellington 120, 121
Wells, C. B. 66, 70
West Indies 90, 91
White, T. .C 55, 72
Wilcox, A. S. 64
Wilcox, Hon. G. N. 55
Wild Bird Law 37
Wolters, Carl 72
Woods, S. P. 71
Wood and Timber 19, 22, 42
Wyoming 167, 169

Young, Alexander 105

PUBLICATIONS FOR DISTRIBUTION.

BOARD.

Report of the Commissioner of Agriculture and Forestry for 1900; 66 pp.
Report of the Commissioner of Agriculture and Forestry for 1902; 88 pp.
* First Report of the Board of Commissioners of Agriculture and Forestry, from July 1, 1903, to December 31, 1904; 170 pp.
Second Report of the Board of Commissioners of Agriculture and Forestry, for the year ending December 31, 1905; 240 pp.; 8 plates; 10 text figures.
Third Report of the Board of Commissioners of Agriculture and Forestry, for the year ending December 31, 1906; 212 pp.; 3 plates; 4 maps; 7 text figures.
Fourth Report of the Board of Commissioners of Agriculture and Forestry, for the year ending December 31, 1907; 202 pp.; 7 plates.
"Notice to Importers," by H. E. Cooper; 4 pp.; 1903.
"Digest of the Statutes Relating to Importation, Soils, Plants, Fruits, Vegetables, etc., into the Territory of Hawaii." General Circular No. 1; 6 pp.
"Important Notice to Ship Owners, Fruit Importers and Others. Rules and Regulations Prohibiting the Introduction of Certain Pests and Animals into the Territory of Hawaii." General Circular No. 2; 3 pp.; 1904.

DIVISION OF ENTOMOLOGY.

"The Leaf-Hopper of the Sugar-Cane," by R. C. L. Perkins. Bulletin No. 1; 33 pp.; 1903.
** "A Catalogue of the Hemipterous Family Aleyrodidae," by G. K. Kirkaldy, and "Aleyrodidae of Hawaii and Fiji with Descriptions of New Species," by Jacob Kotinsky. Bulletin No. 2; 102 pp.; 1 plate; 1907.
* "On Some Diseases of Cane Specially Considered in Relation to the Leaf-Hopper Pest and to the Stripping of Cane," by R. C. L. Perkins. Press Bulletin No. 1; 4 pp.; 1904.
"A Circular of Information," by Jacob Kotinsky. Circular No. 1; 8 pp.; 1905.
"The Japanese Beetle Fungus," by Jacob Kotinsky and B. M. Newell. Circular No. 2; 4 pp., cut; 1905.
Report of the Division of Entomology, for the year ending December 31, 1905. Reprint from Second Report of the Board; 68 pp.; 3 plates; 10 text figures.
Report of the Division of Entomology, for the year ending December 31, 1906. Reprint from Third Report of the Board; 25 pp.; 7 text figures.
Report of the Division of Entomology, for the year ending December 31, 1907. Reprint from Fourth Report of the Board; 18 pp.; 1 plate.

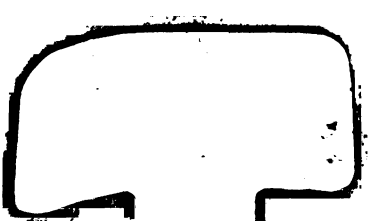
DIVISION OF FORESTRY.

* "Forest and Ornamental Tree Seed for Sale at Government Nursery." Press Bulletin No. 1; 3 pp.; 1905.
"Suggestions in Regard to the Arbor Day Tree Planting Contest." Press Bulletin No. 2; 7 pp.; 1905.
"An Offer of Practical Assistance to Tree Planters." Circular No. 1; 6 pp.; 1905.
"Revised List of Forest and Ornamental Tree Seed for Sale at the Government Nursery." Press Bulletin No. 3; 4 pp.; 1906.
"Instructions for Propagating and Planting Forest Trees." Press Bulletin No. 4; 4 pp.; 1906.
Report of the Division of Forestry, for the year ending December 31, 1905. Reprint from Second Report of the Board; 77 pp.; 5 plates.
Report of the Division of Forestry, for the year ending December 31, 1906. Reprint from Third Report of the Board; 123 pp.; 4 maps.
Report of the Division of Forestry, for the year ending December 31, 1907. Reprint from Fourth Report of the Board; 70 pp.

DIVISION OF ANIMAL INDUSTRY.

"Inspection of Imported Live Stock." Rule 1; 1 p.; 1905.
"Inspection and Testing of Imported Live Stock for Glanders and Tuberculosis." Rule 2; 1 p.; 1905.
"Concerning Glandered Horse Stock in the Territory." Rule 3; 1 p.; 1905.
Report of the Division of Animal Industry, for the year ending Dec. 31, 1905. Reprint from Second Report of the Board; 62 pp.
Report of the Division of Animal Industry, for the year ending Dec. 31, 1906. Reprint from Third Report of the Board; 41 pp.; 3 plates.
Report of the Division of Animal Industry, for the year ending Dec. 31, 1907. Reprint from Fourth Report of the Board; 104 pp.; 6 plates.

---

* Out of Print.
** This Bulletin will be sent only to persons interested in the subject.
Any one or all of the publications listed above (except those marked *) will be sent to residents of this Territory, free, upon application to Mailing Clerk, P. O. Box 331, Honolulu.

3 2044 103 119 392